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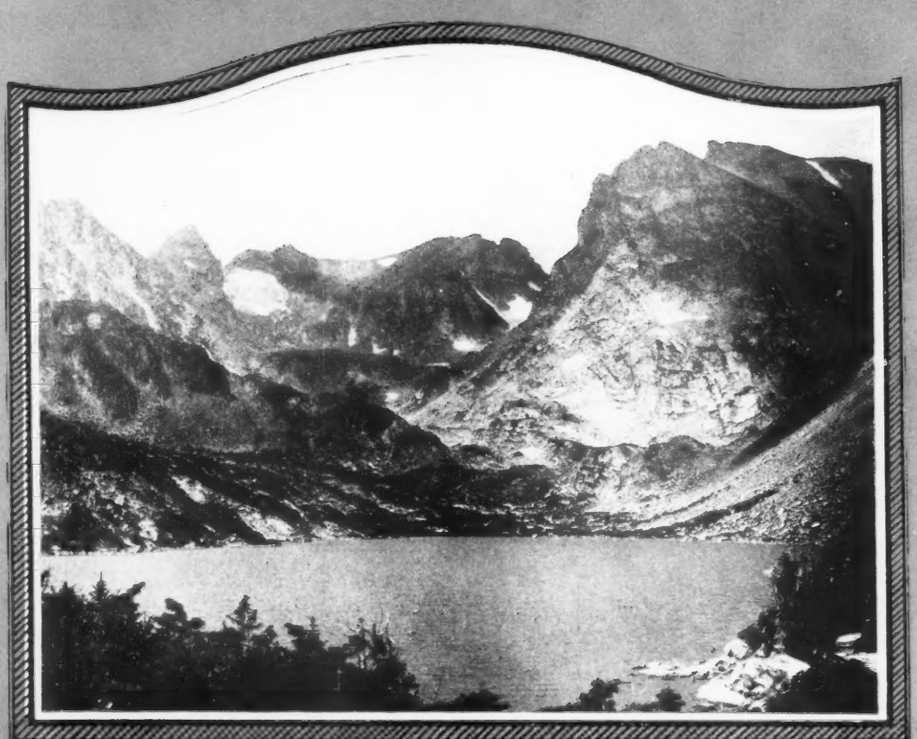

ISABEL LAKE, HIGH UP IN THE ROCKIES, HAS BEEN TAPPED BY TUNNELING TO IRRIGATE FARMLANDS FAR BELOW

Alexandria Again Center of Interest
A. S. Taylor

Cathedral of St. John The Divine
R. G. Skerrett

Water-Supply Tunnel To Pierce 4,000 Feet of Granite
G. H. Dacy

Automobile Laundry the Latest of Conveniences
H. H. Starkey

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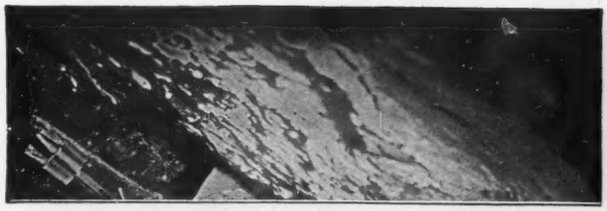

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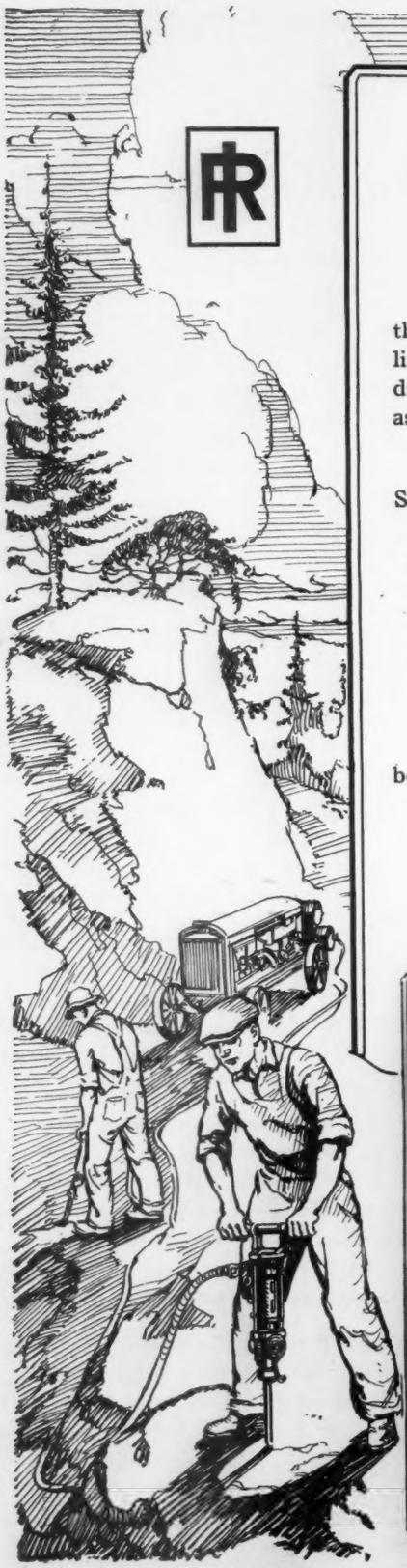

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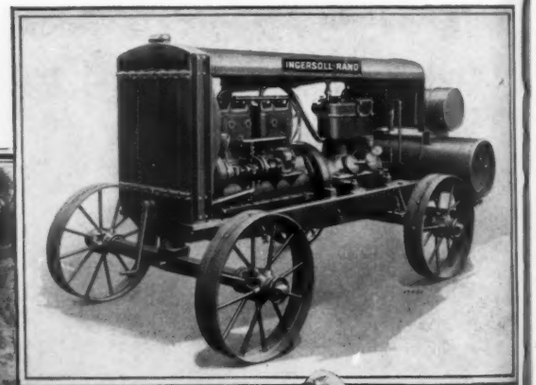

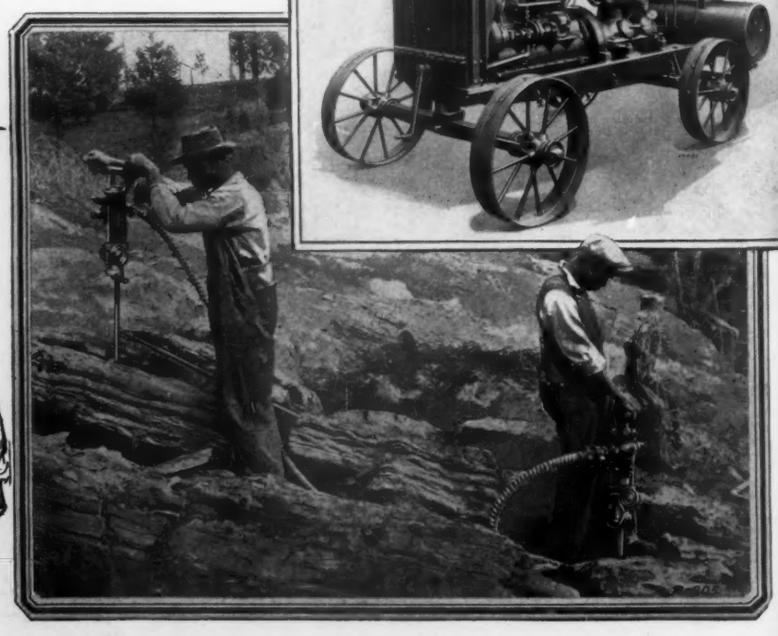

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Compressed Air Magazine

NEW-YORK LONDON PARIS

PRINCIPAL OFFICES
BOWLING GREEN BUILDING
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NEW YORK

VOL. XXXI, NO. II

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Compressed Air Magazine Co.
FEBRUARY, 1926

Cathedral of St. John The Divine

Work on the Magnificent Nave is Going Forward Steadily and Should be Finished in the Course of Three Years

By ROBERT G. SKERRETT

THE very bigness of a cathedral, like the heart of a truly big mother, welcomes all who may need comforting ministration. The very bigness of such a spiritual haven nullifies that sectarian aloofness which may characterize lesser places of worship. Thus, a cathedral fills a place that is peculiarly its own in the spiritual life of a people; and it was to meet such a need that a charter was obtained for the Cathedral of St. John the Divine as far back as 1873.

Cathedrals do not rise in a day: they commonly represent the cumulative efforts of years and even generations. The story of the Cathedral of St. John the Divine is no exception to this rule. It was not until nineteen years after the charter was granted that the cornerstone was laid on St. John's Day—December 27, 1892; and nearly seven years elapsed before the first service was held in the crypt. In its present form, the Cathedral is decidedly incomplete; and even some of the work already done will have to be undone in order to make possible the consummation of the altered plans which have finally been adopted.

The Cathedral of St. John the Divine will adhere to the best traditions of Gothic architecture: it will be fashioned of massive masonry and be so built that it will be standing for centuries to come. Because no modern steel framing will be used in the structure's fabrication, the physical evolution of the Cathedral must of necessity be gradual and somewhat slow. Furthermore, the present plans can be carried to fulfillment only when sufficient funds are available for that purpose. The total sum needed to do this will, according to present estimates, amount to $15,000,000; and under the vigorous campaign initiated by Bishop William T. Manning more than half of this impressive sum has been subscribed or pledged.

"IN the Middle Ages," so Victor Hugo said, "men had no great thought that they did not write down in stone."

It was that urge to lasting expression that inspired the peoples of that period to lay the foundations for those beautiful cathedrals which have since been the wonderment of all men.

With a similar desire to perpetuate in tangible form the deepest impulses of life within our national gates, the devotees of many creeds are helping to rear on Morningside Heights in New York City the Cathedral of St. John the Divine.

When this architectural masterpiece is brought to completion some years hence, it will be an enduring monument to the spiritual best of our millions, without any limitations as to their denominational differences or their racial origins. This will be true then, as it is today, because the congregations which now crowd the existing cathedral structure constitute what might appropriately be termed cross sections of America's complex life.

The present plans for the Cathedral are the outcome of a series of developments which have followed the first award made to Messrs. Heins & LaFarge in July of 1891, and represent years of intensive study on the part of Dr. Ralph Adams Cram, who was appointed consulting architect by the Trustees of the Cathedral of St. John the Divine in 1911. Without any disparagement to his predecessors, Doctor Cram was confronted with a colossal task when he undertook the work of redesigning the Cathedral so that it would adhere throughout to the best precedents set by the wonderfully beautiful French Gothic style of architecture. To achieve this end, he had to design a nave, transepts, and crossing, and to remodel the present choir so as to insure final harmony in the whole complex fabric of the Cathedral.

It is not possible within the space available to detail the various aspects of his problem and to make clear the magnitude and the real nature of the achievement which took sixteen years of study and planning on the part of Doctor Cram. In some respects, Doctor Cram has broken away from precedent in developing certain features of the design; and his professional brethren have been unstinted in their praise of what he has done. Indeed, one competent authority, Dr. Alfred D. F. Hamlin, Professor of Architecture, Columbia University, New York City, has said: "Nothing comparable to this superb design has ever been conceived or executed in America; and the cathedrals of Europe may fairly be challenged to surpass or even to equal it."

When completed, the Cathedral will be the greatest structure of its kind in the English-speaking world, and will be among the most imposing ecclesiastical buildings ever erected. Compared with St. Paul's in London, which has an area of 59,700 square feet, St. John the Divine will cover a ground space of 109,082 square feet. Again, the Cathedral will have an exterior length of 601 feet, and in this respect will exceed England's famous Winchester Cathedral by 45 feet. Its magnificent

Left—General view of the Mohegan Quarry near Yorktown, N. Y.

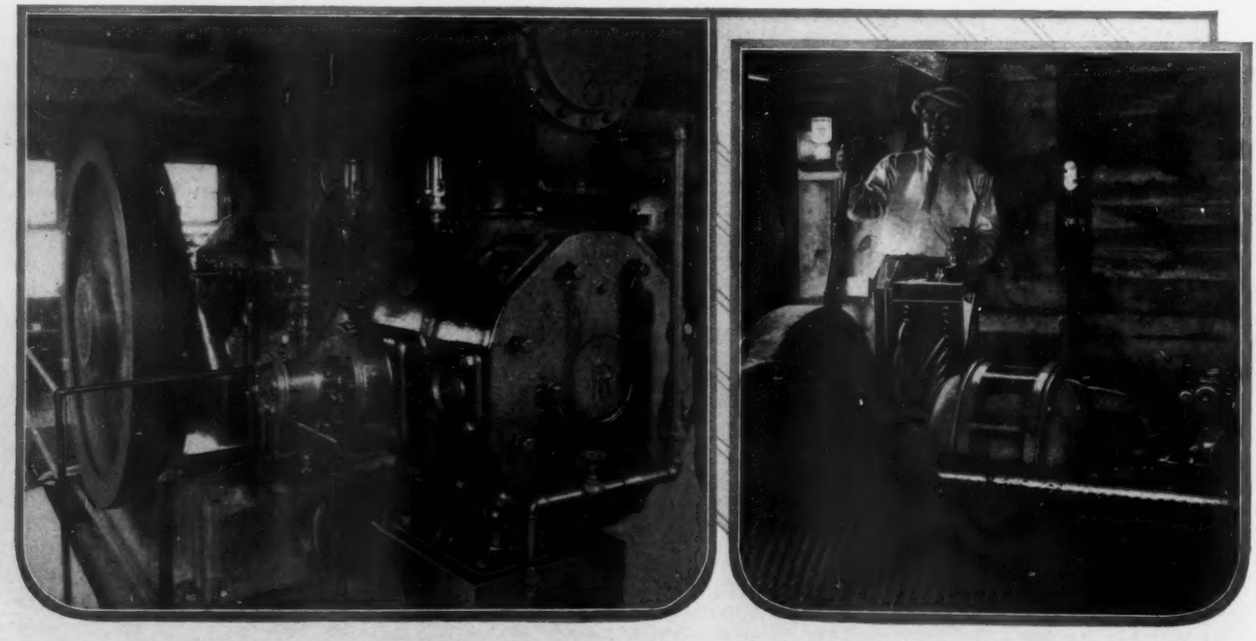
Right—Present state of the Cathedral, showing in the foreground active work on the nave.

Circle—An X-70 drill, mounted on a quarry bar, about to drill a line of holes for "broach channeling."

nave will rank in architectural beauty with that of the famous cathedrals of Seville, Milan, and Bourges.

Inasmuch as our readers may wish to know how the Cathedral of St. John the Divine will compare with other notable ecclesiastical structures, we are including a table which should prove of interest. At the present time, the body of the Cathedral, the nave, and certain other essential parts have yet to be built. As someone has expressed it, the Cathedral today "is like an uncompleted anthem, but half sung, flung up to God." In its growth and in its climax the Cathedral will represent the offerings of the rich and the poor; it will be an altar on which have been laid the gifts of all sorts and conditions of men.

The tip of the 30-foot cross surmounting the towering spire will rise to a height of 631 feet above tidewater, owing to the commanding position of the Cathedral on Morningside Heights. The edifice will, therefore, stand silhouetted high against the sky and be visible throughout a radius of many miles. Indeed, it is likely that the spire can be seen from afar by navigators approaching the Port of New York. Perhaps it will serve to a



Left—The 19-inch stroke, oil-engine compressor unit installed in the power house of the Grenzi & Ellis plant.
Right—Electrically operated hoist which handles the cars on the inclined railway running from the cutting shed up to the quarry.

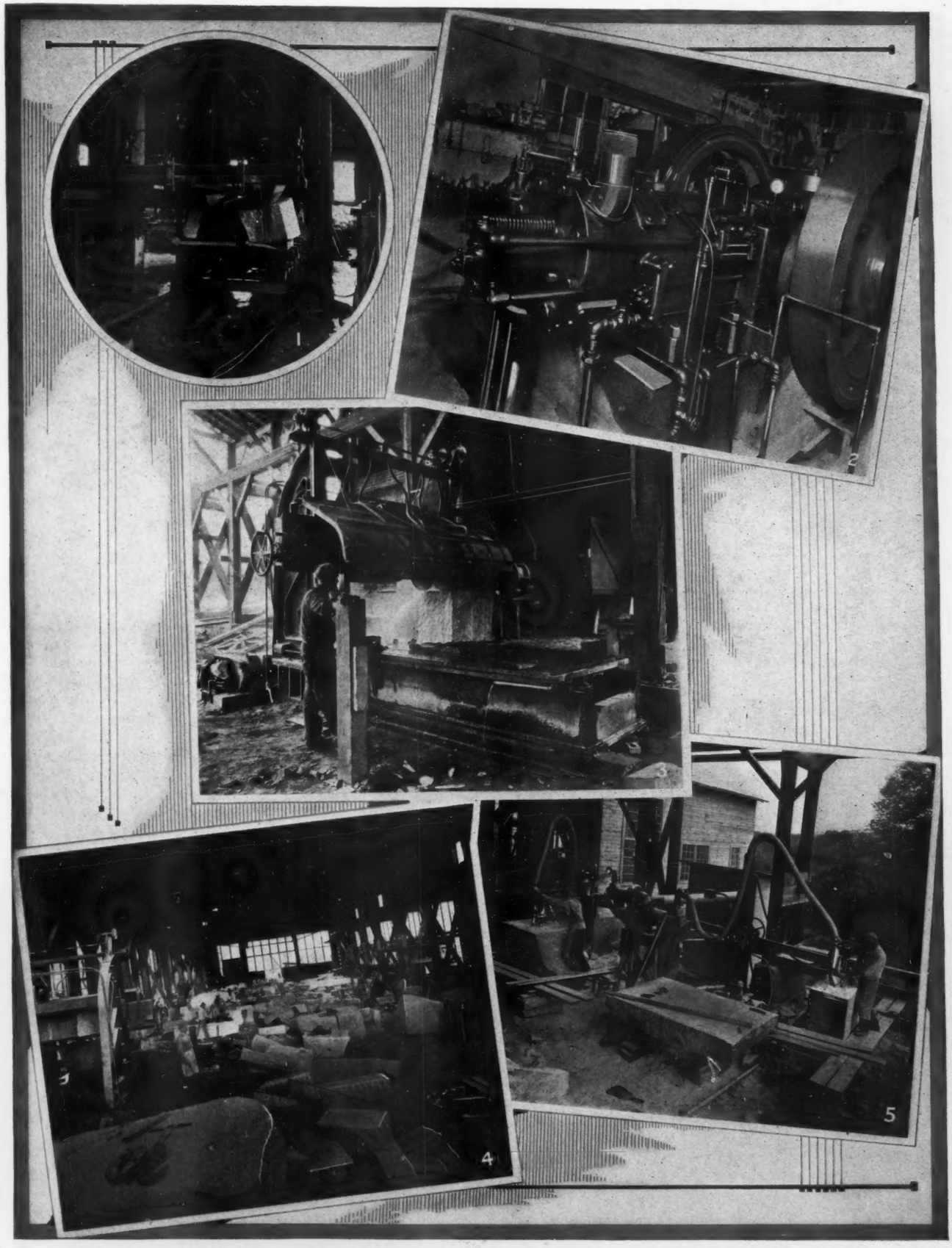


Fig. 1—Sawing granite into slabs or blocks for subsequent cutting into specified forms. Fig. 2—This 100-B.H.P. oil engine drives the generator which furnishes current for many purposes throughout the cutting shed and the quarry. Fig. 3—Here are seen electrically driven carborundum disks which slot or edge pieces of granite that are afterwards finished by hand. Fig. 4—The stone or cutting shed, which has lately been enlarged and which will have to be enlarged again to take care of all the work in prospect. Fig. 5—These compressed-air-driven surfacers make comparatively short work of dressing large blocks of granite for the Cathedral.

Top, left—Corner of the cutting yard.
Top, right—Cutting shed seen from the railway near the quarry.
Bottom, left—This thin slab of granite possesses a good deal of longitudinal strength.
Bottom, right—Mr. Bruno Grenzi standing beside the cornerstone of the nave.

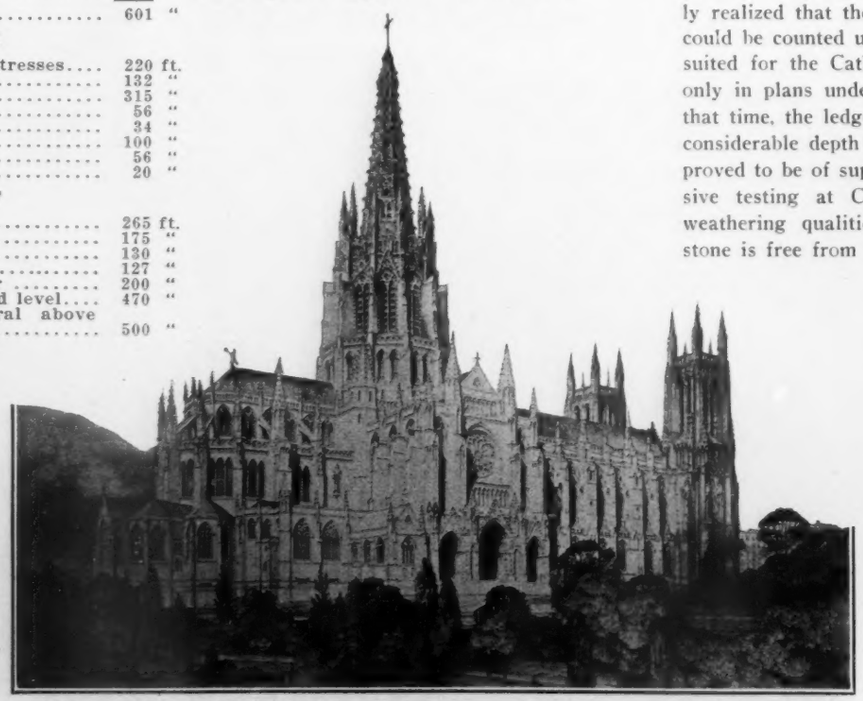
fuller understanding of the magnitude of the Cathedral if we give the dimensions of its outstanding architectural features:

LENGTH	
Western towers	50 ft.
Nave	225 "
Crossing	100 "
Choir	170 "
St. Saviour's Chapel	56 "
Total length	601 "

WIDTH	
West front, including buttresses	220 ft.
Nave and aisles, exterior	132 "
Transepts	315 "
Nave, interior	56 "
Aisles, each	34 "
Crossing	100 "
Choir	56 "
Ambulatory	20 "

HEIGHT	
Western towers	265 ft.
Ridge of nave roof	175 "
Nave vaults, above floor	130 "
Choir vaults, above floor	127 "
Crossing vault, above floor	200 "
Central spire, above ground level	470 "
Total height of Cathedral above ground level	500 "

Even as the Cathedral stands today, representing only a small part of what it will be when finished, still it draws to it annually more than 100,000 persons. With the completion of the nave, which is now in course of construction, the Cathedral will be able to accommodate several times that number in the course of a year. Reference to the dimensions cited will make this understandable. The walls of the nave are being formed of what is known as Mohegan golden granite. This beautiful, mellow stone comes from a quarry situated near Peekskill, N. Y.; and the granite was discovered by chance by Mr. Heins, one of the architects responsible for the original design of the Cathedral.



Cathedral of St. John the Divine as it will appear, from the north, when completed.

Mr. Heins then lived in the vicinity of Peekskill, and in his leisure hours was given to tramping over the surrounding hills. On one of his hikes he came upon the outcropping of the ledge which has since been developed into the quarry from which the golden granite is obtained. He was impressed with the warm coloring of the granite, and instantly realized that the material, if enough of it could be counted upon, would be wonderfully suited for the Cathedral, which then existed only in plans undergoing elaboration. Since that time, the ledge has been opened up to a considerable depth; and the granite has been proved to be of superior strength after extensive testing at Columbia University. The weathering qualities are excellent, and the stone is free from iron or other staining materials. The quarry produces two kinds of golden granite — that is, light and dark. The dark golden granite is used for main or broad surfaces, while the lighter golden granite is employed for trim.

The quarry has been intermittently worked ever since the first of the granite was taken out for the initial building operations in connection with the Cathedral of St. John the Divine, but it has been only within the last twelve months that ac-

tivities at the quarry have been greatly stimulated. This is due to an award made in February of the year gone for 100,000 cubic feet of finished granite to be used on the exterior of the nave. All told, the Mohegan Quarry and the associate cutting plant will have enough work to keep the enterprise busy for years to come. This explains why Grenzi & Ellis, Incorporated, have found it advantageous to completely modernize their power plant and to increase proportionately their stone-cutting facilities.

Working up a block of golden granite taken from the Mohegan Quarry. The block was channeled to approximate form with an X-70 drill.

Until last year, power at the Mohegan Quarry was furnished by a steam plant which was just about able to meet the somewhat modest operating demands which had previously prevailed. With the order for 100,000 cubic feet of finished granite it became necessary not only to increase the working equipment at the quarry but also to amplify the stone-cutting or stone-finishing facilities within the shed. It was then a question of either buying electric power or installing oil engines for driving a generator and an air compressor large enough to meet the new demands. After a careful survey of the situation, Messrs. Grenzi & Ellis, Incorporated, elected to install oil engines and to make their plant independent of outside sources of power.

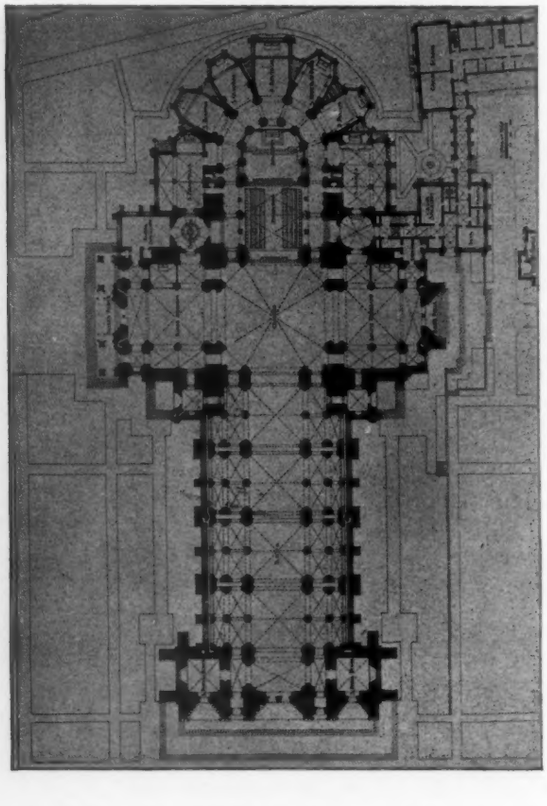
In addition to lighting the stone-cutting shed, electricity is employed to drive an edger, stone saws, traveling cranes, grindstones, surfacers, a water-supply pump, etc. Current for these purposes is provided by a 90-Kw. alternating generator which is belted to a 100-H.P. Ingersoll-Rand oil engine. This generator was purposely provided oversize so as to insure ample Kv-a. capacity for starting the numerous motors on the premises. It runs at the rate of 1,200 revolutions per minute, and produces a 60-cycle current of 240 volts.

Compressed air for numerous services, both at the quarry and within the shed, is furnished by a 100-H.P. oil engine compressor unit of the well-known "POC-2" Type. The fuel-oil consumption of the two prime movers averages 300 gallons a week. A week consists of 6 working days, which require the machines to run from 10 to 11 hours daily. The fuel oil costs 8.5 cents a gallon delivered. Aside from the marked economy made possible by generating their own power, Grenzi & Ellis, Incorporated, are outspoken in their praise of the manner in which the two units have performed since they were installed.

Even though the capacity of the finishing shed was doubled after receiving last February the order for 100,000 cubic feet of finished granite for the exterior of the nave, the plant will again have to be greatly enlarged if it is to produce the stone which will be required in rearing the west front. Interesting as it would be to describe the successive steps by which the blocks of granite are cut and finished for their various positions in the Cathedral structure, we shall have to omit these details. However, the accompanying illus-

Top, left—Putting the finishing touches on cut granite with air tools.
Top, right—Block of granite split by the plug-and-feather method.
Bottom, left—A line of plugs and feathers in place preparatory to splitting a large block of granite.
Bottom, right—Completing a beautiful memorial bench of golden granite.

The present choir and high altar of the Cathedral of St. John the Divine.



Ground plan of the Cathedral. This will serve to give some iden of the splendid proportions of the structure.

trations will help to give a broad idea of the outstanding operations or treatments by which the granite is cut, shaped, and finished in accordance with the designs of the architect.

The dimensional stone is quarried by a method commonly known as "broach channeling" combined with the use of a few splitter or gadder holes drilled at right angles to the channel and perpendicular to the sheeting plane of the granite. The channeling is done with an X-70 air-driven drill mounted upon a quarry bar. This machine first drills a succession of closely spaced holes, after which a broad-bladed steel, called a broaching tool, is substituted for the drill steel. The broaching tool breaks down the thin bridges between the holes, in line; and in this way a channel is cut from the top of the block down to the underlying sheeting plane. The gadder holes at the back of the block are drilled with a "Jackhamer"; and small charges placed in these holes serve to break the block loose from the ledge along the line desired.

This method of channeling is now employed extensively, and is especially effective in granite quarries where the hard rock can best be penetrated quickly by using a hammer drill having the power and speed of the X-70. When mounted on a quarry bar the X-70 can be easily and quickly shifted so as to drill a line of closely spaced holes, and it can be similarly moved when breaking down the intervening cores or bridges of rock which must be broken through in order to form the channel. As is well known to the industry, channeling done in this manner can be done faster and at a considerably lower cost than when the work is performed by regular channeling machines. At the present moment, thanks to their up-to-date equipment, Grenzi & Ellis, Incorporated, are able to quarry the granite and to finish it for the stonemasons more rapidly than the workers at the Cathedral can place the material.

According to the present program, it is the intention of the operators of the Mohegan Quarry to continue to get out granite during the entire winter season. The quarry is so situated that it is exposed to the sun throughout nearly the whole of the daylight period, and this contributes to the comfort of the quarrymen during cold weather and also facilitates the rapid dissipating of any accumulations of snow or ice. The quarry stands at considerable height on the neighboring hillside above the cutting shed, and the quarried granite is delivered to the shed by an inclined railway. Only exceptionally severe winter weather could possibly interfere with the service of this railway. Compressed air for operating the drills is delivered to the quarry by a pipe line laid on the ground, as is the usual practice in most quarries. All water lines on the property are blown dry on cold nights by means of compressed air.

The dominating figure at the Mohegan Quarry is Mr. Bruno M. Grenzi, and this account would be de-

CATHEDRAL	Area	Height of Towers, Spires, or Domes	Height Interior	Length Exterior	Width Central Aisle
	Sq. Ft.	Feet	Feet	Feet	Feet
St. Peter's Rome	227,069	448	150	718	100
Seville, Spain	128,570	400	150	430	60
St. John the Divine, New York	109,082	500	130	601	56
Duomo, Milan	107,000	355	153	500	60
Cologne, Germany	91,464	512	145	511	41
Amiens, France	71,208	361	140	521	40
St. Sophia, Constantinople	70,000	185	184	350	100
Chartres, France	68,260	378	122	507	50
Notre Dame, Paris	64,108	204	110	390	45
York, England	63,800	198	99	486	51
St. Paul's, London	59,700	363	89	460	40
St. Patrick's, New York	57,768	339	112	332	48
Winchester, England	53,480	...	78	556	35
Rheims, France	48,985	270	124	483	40
Westminster Abbey, London	46,000	225	101	511	35

cidedly incomplete without reference to Mr. Grenzi's part in providing the golden granite for the Cathedral. This story is one more evidence of the opportunities which America offers to those within her gates that are willing to work and desirous of giving of their best. Mr. Grenzi, as a lad of fifteen years, came to the United States in 1898. His people before him were long identified with the working of stone, and it was a natural thing for him to seek employment in that field of industry. Successively, he worked in quarries in Maine, in Vermont, in Pennsylvania, and in New York; and in 1900 he went to what is now known as the Mohegan Quarry, which lies within the administrative limits of Yorktown—a little way outside of Peekskill.

Mr. Grenzi started in business for himself in 1904. Step by step he mastered the various procedures or practices associated with the quarrying and the cutting of stone for structural purposes. In 1917 Grenzi and Ellis became associated in operating the Mohegan Quarry and the stone-cutting plant forming part of the property; and three years later a third partner was added and the firm was incorporated to give it the business standing considered essential in a company that might be asked to do millions of dollars worth of work in connection with the Cathedral of St. John the Divine. Mr. Bruno Grenzi is intimately familiar with every phase of the activities at the Mohegan quarry; and no man there works harder than he does. Not a single piece of stone is permitted by him to leave the plant until it has been inspected by him and found to be satisfactory in every particular.

The general contractors for the construction of the Cathedral are Messrs. Jacob & Youngs, of New York City; and Grenzi & Ellis, Incorporated, are doing their work as subcontractors.

SETTING UP A COMPRESSOR UNDER DIFFICULTIES

ERECTING and placing machinery in out-of-the-way parts of the world often presents many difficulties that tax the resourcefulness of the resident engineer. A good example of this is what happened not long ago on the property of the Bonanza Mines Company at Bluefields, Nicaragua. The problem was to set up a large compressor when no cement was available for the construction of a suitable foundation.

The difficulty was overcome by fashioning a foundation of timbers laboriously hewed square from the hearts of ironwood and locust logs. The logs were squared to 24x34 inches, and care was taken to cut off all sapwood. All told, the logs weighed approximately 8 tons, and they were mitered and then bolted together with 1½-inch bolts. The spaces between the logs, when assembled on partly solid rock, where filled in and tamped. Upon this timber foundation the compressor was placed and secured to the timbers by means of ¾-inch wood screws.

Notwithstanding the unusualness of this arrangement, the timber bed answered admirably, and the machine was held as rigidly in position as if it had been placed upon a foundation of solid concrete. Ironwood and locust are not attacked by destructive insects nor are they affected by dampness—in fact, residents of the tropics declare that woods of these sorts will be found sound at the end of from 25 to 30 years of service.

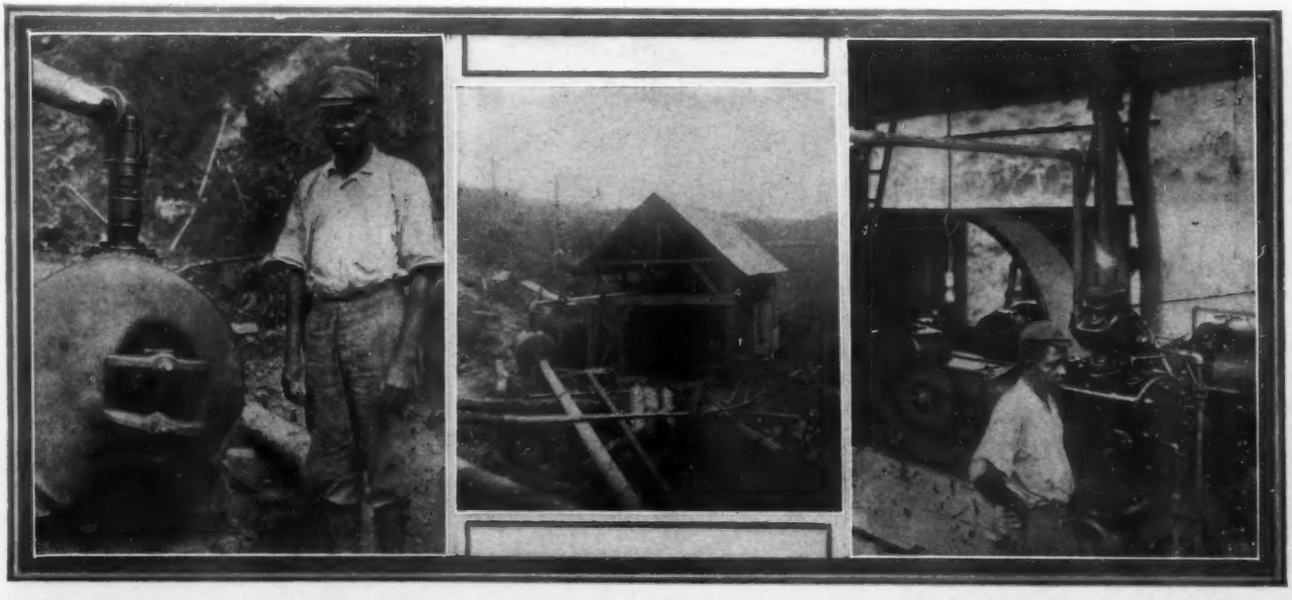
At the mines in question, compressed air has been an essential aid for a long while in carrying on operations; and some of the compressors on the job have been in use well-nigh continuously for three decades. Among other services, compressed air is employed to blow a whistle that has a bell 5 inches in diameter; and the booming signals so broadcasted can be heard up and down the neighboring valleys for a distance of many miles.

The president of the mining company has written: "You will notice in one of the pictures the 6-inch air line laid up the hill, and you can see the unfinished building over the new compressor. To the left of the building, on a line with the rafters, we have since placed a water tank, and on the right, at the lowest point, we have put a waste-water tank. On top of the waste-water tank we have put one of your Cameron pumps. During the dry season, if need be, we are equipped to pump the water from the waste-water tank to the tank on the hill so as to supply water by gravity for cooling the compressor cylinders, etc. The Creole in the picture had charge of installing the compressor, and now he operates it."

During the forty-fifth annual meeting of the Raw Sugar Planters' Association, recently held at Honolulu, it was brought out that, notwithstanding a decrease in acreage, the production of sugar in Hawaii has been increased during the past decade from 620,000 to 780,000 tons per annum through the effective application of fertilizers. A marked advance in the control of cane disease has also contributed to the larger yield.

Extensive harbor improvements at Quebec have been undertaken by The Northern Construction Company, of Vancouver, B. C. For the execution of the contract there will be required, among other things, 20,000,000 board feet of timber, which is to be brought to the scene of activities from the Pacific coast by way of the Panama Canal.

About 95 per cent. of the electric energy produced in Great Britain is derived from steam.



Air receiver, compressor house, and one of the compressors at the plant of the Bonanza Mines Company in Bluefields, Nicaragua.

House Wrecker Makes Effective Use of Paving Breaker

By THE STAFF

IN medieval times the battering ram was extensively used to break down the thick walls of a castle or a fortress in an effort to bring an enemy to terms. Recently, in promoting the peaceful pursuit of razing a building, the ingenious contractors employed a kindred method but with what might be called an up-to-date battering ram that is operated by air instead of by man power.

The modern battering ram in question is, in fact, what is commonly known as a pneumatic paving breaker, and this air-driven tool was utilized to raze the Horace Noble Memorial, in Buffalo, N. Y., which had to make way for a new structure. The work of tearing down the memorial was awarded to the enterprising wrecking firm of Green & Lanctot, Incorporated, also of Buffalo, and their mechanical equipment for the task was composed in part of a 5x5-inch portable compressor and a number of paving breakers.

Demolishing the dome of the Horace Noble Memorial before razing the body of the structure.

Although a comparatively new building, having been reared by the Buffalo Commandery of Masons as recently as 1910, the Horace Noble Memorial was doomed when the city purchased the property for a high-school site. Being of sturdy construction, of paving block with sandstone trim, the memorial represented something of a problem to the wreckers. However, instead of going about the work in the usual fashion, the contractor struck a new note in house razing that not only proved entirely satisfactory but was instrumental in saving much time and money. Instead of beginning at the top and laboriously working downward floor by floor, the contractor started at the foundation—bringing the building down much as masonry smokestacks are occasionally razed.

Passersby may have been interested if not startled to see the wrecking crew remove the foundation stones of the structure; and it was for this part of the work that the modern battering ram—the air-driven paving breaker—was used to good effect. One of our illustrations plainly shows the havoc wrought by these pneumatic tools, which are primarily designed to tear up concrete streets and roadways.

With the studding thus exposed, the next step was to set fire to the woodwork; and, after the flames had slowly but surely eaten their way through the supporting framework, the building came crashing to the ground. The site was then cleared for the erecting of the school; and the reclaimed building material sold for re-use.

How the paving breakers undercut the masonry walls for the purpose of exposing the wooden supports which were afterwards burned away, thus tumbling the building to the ground.

To the layman, the outstanding features of this wrecking job are the way in which the work was done and the use of paving breakers for the undermining of the walls. But to the man who is engaged in the same business as Green & Lanctot, Incorporated, the outstanding facts are that by the employment of a portable compressor and air-driven paving breakers it was possible for a few men to demolish the well-built Horace Noble Memorial in but five days and at the ridiculously low cost of $250.

PRESSURE TEST FOR FRUIT

THERE is a critical time in the ripening of fruit upon which depends not only its desirability as a dessert but also its qualifications for storing and for transporting. Fruit will not carry well to market if allowed to become too mature on the tree; and if not picked at precisely the right time it may not be at its best for eating. Pressing the fruit with the thumb gives very uncertain results, even to the most experienced; and the need of a more reliable method of determining the relative ripeness of fruit has led the Department of Agriculture to devise a mechanical tester.

The device, somewhat on the order of an automobile tire gage, is portable and handy to use. A protruding plunger, placed against the flesh of an apple or other fruit, penetrates the flesh—recording the pressure required for a given penetration. From these tests, standard pressures are being tabulated. This table, together with the tester, will enable a grower to ascertain just when to harvest his crop either for immediate consumption after shipment or for storage. Furthermore, it will make it possible to establish the critical time at which fruit should be removed from cold storage. As may be readily appreciated, the effects of this work will be far-reaching, as the grower, the dealer, and also the ultimate consumer will be benefited.

Long Island Railroad Celebrates With Its First Oil-Electric Locomotive

TIMES have changed mightily, of course, since an astonished populace lined the banks of the Hudson to cheer the first faltering voyage of Fulton's tiny steamboat. Engineering wonders have come so fast during the past two decades that the average citizen is hard to startle. Progress now seems taken for granted, and the most amazing inventions are received, for the most part, with little acclaim.

Stopping long enough during the demonstration run to allow guests to inspect the oil-electric locomotive.

Occasionally, however, there is added to the romantic history of American railroad transportation a chapter which does carry with it something of the thrill of an older day. Such a thrill was evidently felt on December 22, last, by those residents of Long Island who glimpsed the passing of a mysterious passenger train—propelled by an invisible power, without smoke or cinders, and with no noise other than the rhythmic whir of wheel on rail.

The occasion was an invitation-demonstration of the first 100-ton oil-electric locomotive ever built or bought for an American railroad. The host was George LeBoutillier, Vice-President of the Long Island Railroad Company—the first to place an oil-electric locomotive of this size in regular service. The guests, more than 100 in all, included members of the New York public service and transit commissions, members of the legislature from Long Island and adjacent districts, officials of other railroads, newspaper men, motion-picture operators, and representatives of the General Electric, American Locomotive, and Ingersoll-Rand companies, joint builders of the oil-electric locomotive.

About 70 miles were covered in the interesting run made over various sections of the Long Island's metropolitan freight district. Railroaders all along the line waved friendly greetings as the new-fangled wonder glided through the crowded yards, and the windows of the Long Island's general offices were gay with fluttering handkerchiefs and smiling faces as the locomotive passed. At every station and every grade crossing curious crowds looked on in interested perplexity.

Stops were made at various points to allow guests to inspect the mechanism and to show the ease with which the locomotive is operated in switching work. The uniform smoothness of the performance was the subject of much favorable comment at a luncheon which the Long Island road gave for the demonstration party at the Garden City Hotel, Garden City, Long Island. Mr. LeBoutillier presided at the luncheon, and brief talks were made concerning the important economic possibilities of

Left—Mr. W. B. Potter, chief engineer of the railroad department of the General Electric Company, explaining some of the features of the 100-ton oil-electric locomotive at the recent demonstration on the Long Island Railroad.
Right—Mr. George Le Boutillier, vice-president of the Long Island Railroad, at the throttle of the new 100-ton oil-electric locomotive.

the oil-electric locomotive by W. B. Potter, Chief Engineer of the Railroad Department of the General Electric Company, and L. G. Coleman, Manager of the Locomotive Department of the Ingersoll-Rand Company.

A few days prior to its delivery to the Long Island Railroad, the 100-ton oil-electric locomotive completed the longest run ever made by a locomotive of this type hauling a loaded freight train. The run was made from the plant of the General Electric Company at Erie, Pa., to New York—a distance of 537 miles. No fuel or water was taken on during the trip; and the total cost of both fuel and lubricating oil for the 537 miles was only $26.15. The average fuel cost per locomotive-mile was 4.86 cents. The total kilowatt-hours generated was 3,810, and the fuel cost per kilowatt-hour generated was .685 cent. The fuel cost per 1,000 ton-miles was 12.90 cents.

As is well known, the principle of the oil-electric locomotive is an internal-combustion oil engine which drives a generator, the current from which is applied to motors geared to the axles of the locomotive. The 100-ton locomotive which made the run from Erie to New York is about 46 feet long. The nominal rating of the traction motors at 600 volts is 200 H.P. each, or 800 H.P. for the four motors. The generator is operated by two 300 H.P. internal-combustion engines using low-grade fuel oil. The generator is of the direct-current, compound-wound, commutating-pole type, developing 600 volts. For test purposes, the oil engines were operated continuously during the trip from Erie to New York. An additional fuel saving could, of course, have been attained by shutting down the engines during long stops.

This locomotive was first publicly put through its paces early in December of 1925, when it was demonstrated at the plant of the General Electric Company at Erie for the benefit of a visiting party of railroad officials, engineers, and transportation authorities. Starting from a standstill at the foot of a 1 per cent. grade, with a trailing load of 1,315 tons, the locomotive accelerated up the grade to a speed of 6 miles per hour. Another test showed the oil-electric locomotive with two cylinders cut out of one of her engines, balanced perfectly between the motors.

HOW TURKISH POLICE HANDLE RECKLESS DRIVERS

HOW to deal with the reckless driver is puzzling the traffic authorities of many cities. The following account, taken from the *London Times*, is suggestive; and we can easily imagine that some such drastic measures might be employed to advantage in other parts of the world that boast of considerable more up-to-dateness than one might expect to find in Constantinople.

Dr. Emin Bey, who is nothing if not an energetic prefect of Constantinople, has hit upon a very effective device for imposing upon motor drivers that carefulness which has been so conspicuously absent in the past.

He has issued to the police planks of wood studded with nails, and has given public notice that the police have been authorized to throw these planks about one yard in front of any approaching motor car as they may see fit. In case the car does not stop in time to avoid having its tires either punctured or cut by the nails, this will be regarded as proof that the brakes are defective, and the chauffeur will be punished accordingly.

So far the police appear to have made comparatively little use of these new powers, but the mere threat has had a singularly good effect. Whereas quite recently it was a risky thing to cross even the narrow streets that obtain here, motor cars are now going at such a demure pace that one newspaper has published a cartoon wherein a man, upon being asked by a driver whether he wants a car, replies: "No, thank you. I will take a cab, as I am in a hurry." The threat has been the more effective in that quite a large number of the motor cars are owned by the drivers, themselves, as they would otherwise be out of pocket each time they spiked one or more of their tires upon a plank.

MINUTE WALL DEFLECTIONS CAN BE MEASURED

THE amount of deflection of a 40-inch brick wall brought about by the pressure of but one finger can now be measured by an instrument recently constructed by C. G. Peters of the United States Bureau of Standards. This instrument is so sensitive that upon looking into the eyepiece while someone is walking across the floor of the room the whole building appears to be swaying back and forth as if it were made of cardboard.

The instrument is very simple in construction, and makes use of the interference of light waves. A glass plate is fastened to the wall of the building undergoing test and another plate, mounted in the tube of the instrument, is held close to the first plate. A measure of the light from a helium tube passes through the plate in the instrument and is reflected back into the eyepiece by the plate on the wall. The remainder of the light from the helium tube is reflected directly from the plate in the instrument.

The interference of these two sets of light rays causes light and dark bands to appear in the field of the eyepiece. When the distance between the two plates is changed, the bands move across the field of vision; and any motion equal to the distance between two dark bands represents a deflection of approximately one one-hundred-thousandth of an inch.

This track layer, operated with compressed air, is used by the Southern Pacific Company in constructing new sections of that railroad. The steel rails are loaded on the track layer from flat cars, and are then picked up by air-driven cables which place them where desired through the medium of an overhead arrangement of steel angles to which the cables are attached. The long wooden conveyer at the side of the track-laying car serves to deliver the ties ahead of the track layer.

REFRIGERATION IN THE DYE INDUSTRY

IN a recent visit to the Dalton Works of the British Dyes Corporation, Ltd., it was noted by members of the Society of Chemical Industry how important a part refrigeration plays in the manufacture of dyes. At the plant in question, two ammonia compressors produce daily 150 tons of ice in 100-pound cakes; and another installation, having a capacity of 60 tons of ice a day, supplies cold brine which is distributed throughout various departments where its services are required. Quantities of cracked ice—in fact, as much as 1,000 pounds—are used at one time to cool certain liquids after they have been run into vats.

According to official estimates, Sweden's power resources aggregate nearly 100,000,000,000 kilowatt-hours annually and are far in excess of her demands. Since the laying of the world's largest submarine power cable, linking southwestern Sweden and Denmark, Copenhagen has drawn largely on this source of energy, which is transmitted at 50,000 volts and distributed through public-service utilities. The service is to be widely extended in the near future.

Alexandria Again a Center of Widespread Interest

This Historic Virginia Town is Recovering the Importance Which it Enjoyed in the Days of George Washington

By A. S. TAYLOR

GEORGE WASHINGTON, when fourteen years old, went to live with his brother Lawrence at Mount Vernon on the Potomac River. Seven miles above, on the Potomac, was a modest village which then bore the name of Belle Haven. Three years later—in 1749, Belle Haven became the organized Town of Alexandria mainly through the efforts of Lawrence Washington.

Even though Alexandria evolved but slowly toward the dignity of a municipality, still it soon became a business and a social center for that section of the royal colony. For more than five decades the history of Alexandria was intimately interwoven with Washington's career. Much of his active life had to do with that Virginia town; and he loved the place because of his part in the upbuilding of the community and because it was the home of so many of his friends.

Most of us look upon George Washington preëminently as a soldier and as a wise public executive; but the same qualities of mind made him a shrewd manager of property and a keen man of business. In short, he was what we would now call an especially efficient captain of industry. Thus it is comparatively easy to understand why he should have been a conspicuous figure in guiding the material interests of Alexandria. As long as he lived, Washington played a prime part in the public affairs of the municipality. Perhaps a brief summary will make this participation plainer.

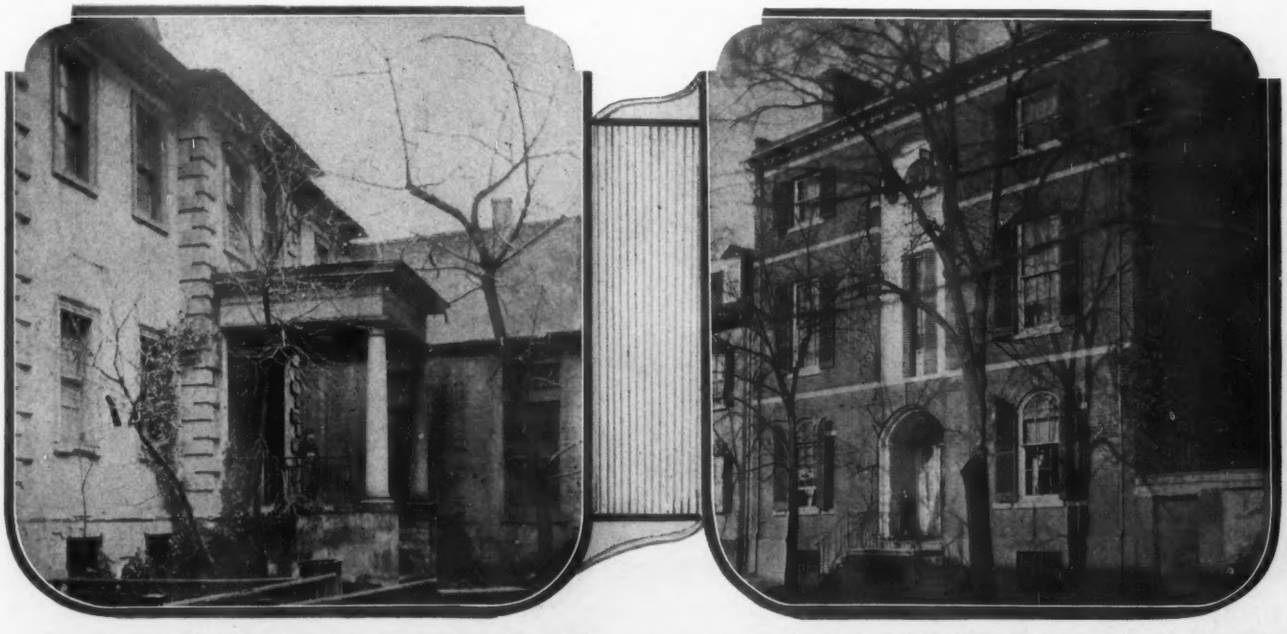
GEORGE WASHINGTON loved Alexandria. That Virginia town was intimately identified with all that he did as a private citizen, as a public character, and as an international figure.

Since then, Alexandria has had its ups and downs, and for a considerable period the city languished in the backwash of the nation's current of material progress. But Alexandria is now staging a comeback, and she is soon to shine anew as a mecca for patriotic Americans.

Not only that, but this historic community plays an essential but little-known part in the well-being and the enjoyment of many millions of our people living on or adjacent to the Atlantic seaboard. The purpose of this article is to sketch briefly something of Alexandria's past and to tell how closely she is identified with our complex present.

It was at the old City Tavern—still standing, that Washington recruited his first command of provincial troops in 1754; and in the Carlyle House—fortunately still surviving, Washington received his commission as a member of General Braddock's staff. From Alexandria, in April of 1755, Washington marched away on that tedious and fateful venture against the French which ended so disastrously at Great Meadows. But for Washington and his fellow provincials, probably few of that combined force of British regulars and provincials would have survived to make their way back to Virginia. Washington represented Alexandria in the House of Burgesses from 1763 to the beginning of the Revolution; he was a member of the town council and its magisterial court; he was a vestryman in the parish; he was the founder of Alexandria's first free school and fire department; he surveyed its streets; he maintained an office in the town for transacting local business; and he was master of the masonic lodge in Alexandria. Washington was a stockholder in the first bank organized in the community; and upon his death the stock held in his name in that bank went to endow the free school established by him in 1785.

On the 22nd of February, 1798, when Wash-



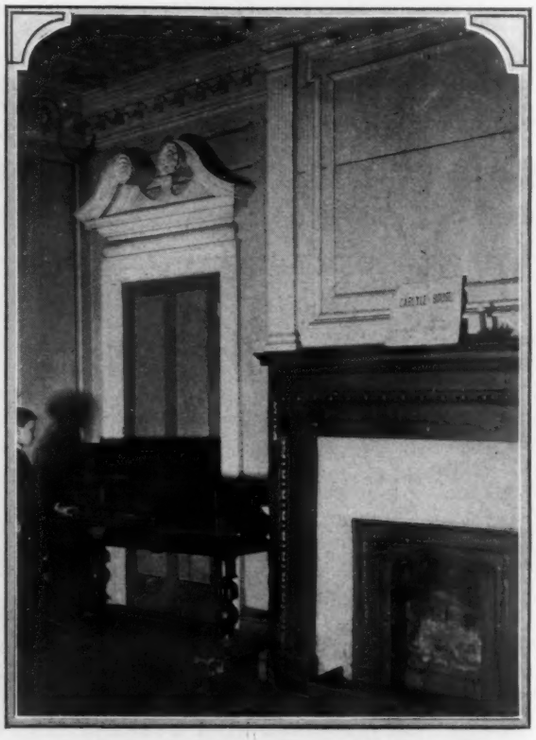
Left—Front of the old Carlyle House which was intimately associated with George Washington. Right—The home reared in Alexandria by Lord Fairfax and built of bricks imported from England.

ington was 66 years old, he and his family joined in a public celebration of his birthday held at Gadsby's Inn; and from the steps of the same historic hostelry, in November of 1799, he held his last military review and gave his last military command to the Alexandria Independent Blues. Alexandria was George Washington's voting place and also his market. Indeed, Washington showed his common sense and his initiative in making the market place in Alexandria a boon to the local citizenry. Let us quote from that chatty chronicler of the period, the Reverend Mr. Weems.

"The neighborhood of Belle Haven was not a desert; on the contrary it was in many places a garden spot, abounding with luxuries. But its inhabitants, the wealthy, were not wise. By the successful culture of tobacco they had money. And having filled their coach houses with gilt carriages and their dining rooms with gilt glasses, they began to look down upon the poorer sort and to talk about families.

"Of course, it would never do for such great people to run market carts! Hence the poor Belle Havenites, though embosomed in plenty, were often in danger of gnawing their nails. And unless they could cater a lamb from some good-natured 'cracker' or a leash of chickens from the Sunday negroes, they were obliged to sit down with long faces to a half-graced dinner of salt meat and journey cake.

"This was the order of the day, A. D. '59, when Washington, just married to the wealthy young widow Custis, had settled at Mount Vernon. The unpleasant situation of the families at Belle Haven soon reached his ears. To a man of his character, with too much spirit to follow a bad example when he had the power to set a good one, and too much wit to look for happiness anywhere but in his own bosom, it could not long be questionable what part he had to act.



Room in the Carlyle House where George Washington received his commission as a member of General Braddock's staff before that doughty Britisher marched against the French and Indians at fateful Great Meadows.

"A market cart was instantly constructed, and regularly three times a week sent off to Belle Haven filled with nice roasters, kidney-covered lamb and veal, green geese, fat ducks and gobblers, chickens by the basket, fresh butter, new-laid eggs, vegetables, and fruits of all sorts. Country gentlemen dining with their friends in town very soon remarked the welcome change in diet. 'Bless us all,' exclaimed they, what's the meaning of this? You invited us to family fare, and here you have given us a lord mayor's feast.' 'Yes,' replied the others, 'thank God for sending a Col. Washington into our neighborhood.'"

The fact that the Virginians, even in the midst of plenty, were often obliged to content themselves with salt meat and kindred simple fare is evidence enough that the people of that time knew little if anything about ice houses and cold storage. The spring house, with its cooling stream of water, was the reliance of a comparatively favored few in keeping fresh for a short while any form of perishable foodstuff. It was not until a long while afterwards that ice houses became commonplace in that section of the Old Dominion; and these ice houses could be counted upon for preserving foodstuffs and for chilling toddies only when a sufficiently severe winter insured the harvesting of ice from the Potomac or adjacent creeks and ponds. Indeed, even within the memory of persons now living, the citizenry of Alexandria went without ice after a too mild winter; and it was not until schooners, years later, began to bring ice from the Kennebec River that the local wants

Left—Old Christ Church of which Washington was a vestryman and where he worshipped when he was in Alexandria. Right—This building, erected about 1792, and then known as the City Tavern, or Gadsby's Inn, was a noted social gathering place for a long while, and it was there that a birthday celebration was held in Washington's honor in 1798.

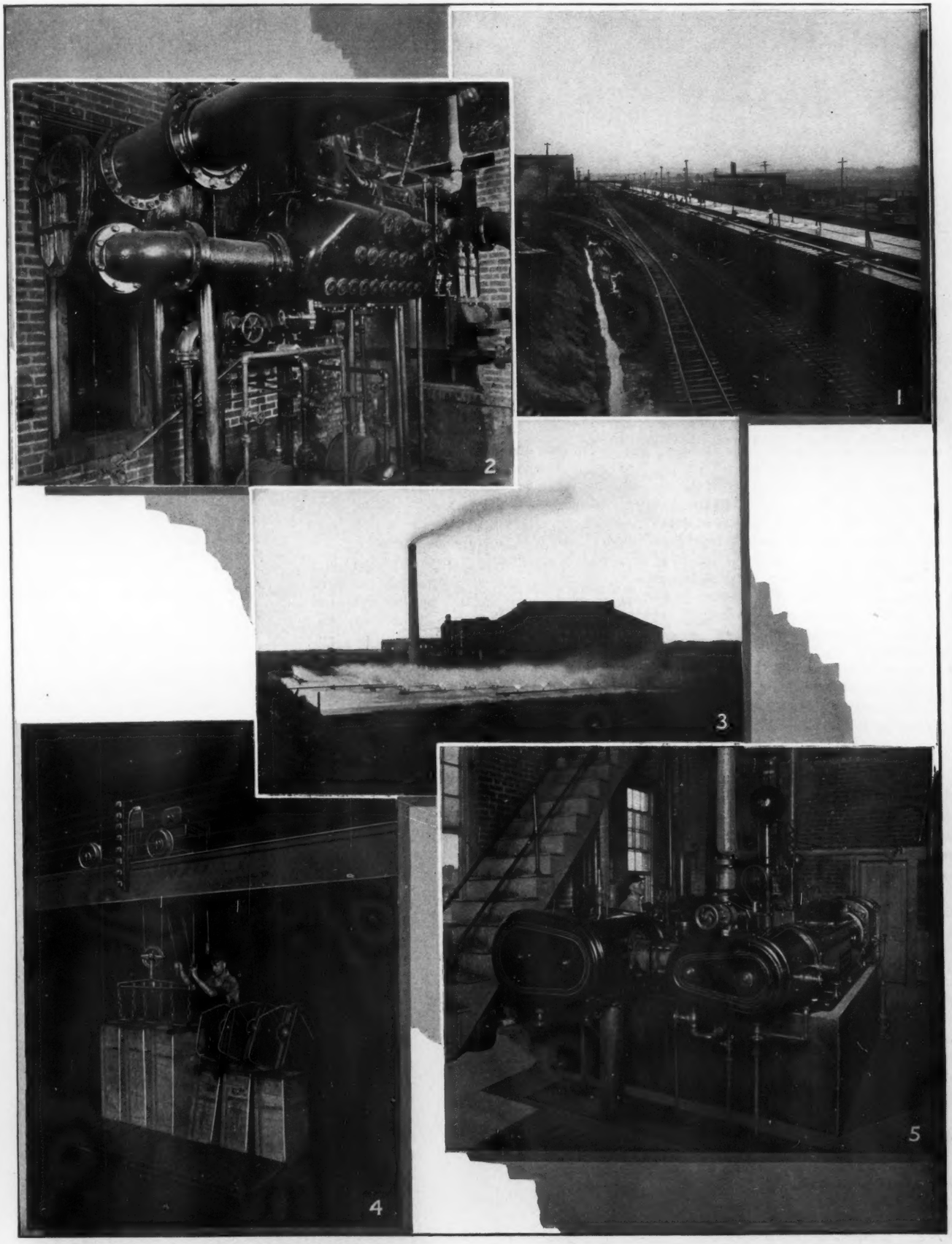
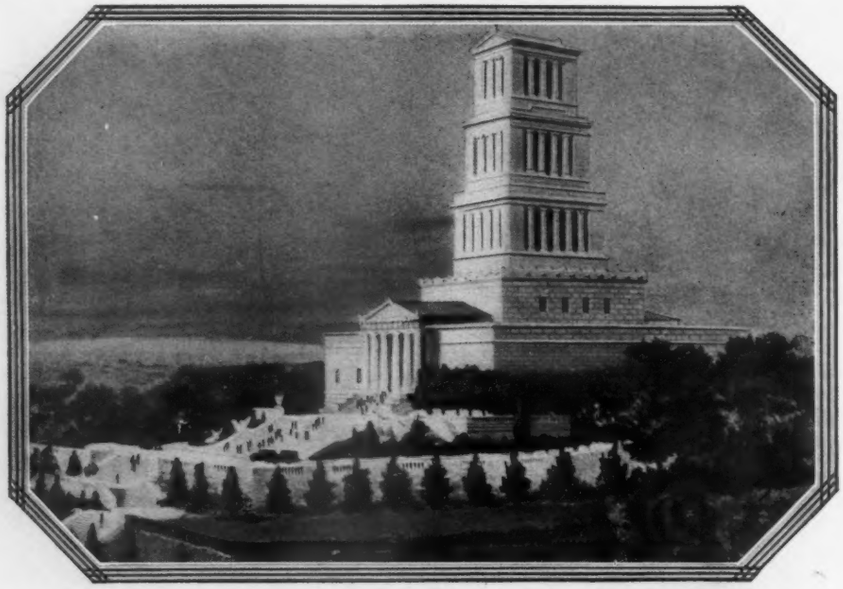


Fig. 1—Re-icing a train of fruit cars at the plant of the Mutual Ice Company.
Fig. 2—Ingersoll-Rand surface condenser in the plant of the Mutual Ice Company.
Fig. 3—Spray pond where the water from the various machines is cooled for re-use in the plant.
Fig. 4—The ice cans are pulled in lots of three by means of the equipment shown.
Fig. 5—This "Imperial" duplex, low-pressure compressor furnishes air for agitating the water during the freezing period.



Masonic memorial to George Washington, now in course of construction, which will dominate Alexandria from Shooter's Hill on the west side of the town.

of this nature could be taken care of despite the vagaries of the weather. We have purposely pictured this phase of the past of Alexandria in order that our readers may duly appreciate how conditions have changed so that Alexandria is able today to provide not only for her own needs but to contribute generously to the welfare and convenience of many millions of people through the medium of refrigeration. And why, may be asked, should the manufacture of ice in Alexandria be of more than local interest? A railroad map of the eastern states will give us a graphic answer to this question.

Through Alexandria now pass a number of the nation's great steam trunk lines which link a considerable section of our very productive Southland with those states farther north that are not similarly blessed with climates so favorable to agriculture. In other words, Alexandria is, in fact, a strategic bottleneck for these north-and-south rail systems, and situated just where the laden trains from the South must stop to have their refrigerator cars replenished with ice. The Potomac Yard, as this halting place is called, handles all the refrigerator cars hauled there by the Seaboard, the Southern, the Chesapeake & Ohio, the Richmond, Fredericksburg & Potomac, and the Atlanic Coast Line. Depending upon the season, anywhere from 150 to 600 cars are re-iced daily.

Substantially 60 per cent. of the fruit and vegetables grown in the South and bound to the northern and the eastern sections of the country reach their destinations by way of the Potomac Yard. The peaks of the traffic occur during the months of April and July when early spring vegetables from Florida crowd the lines and next when Georgia peaches are being rushed to northern markets. The high tide of berries from the Southland comes between the peaks just mentioned. The movement of citrous fruits marks a period apart; and the dullest seasons in the Potomac Yard fall during the interval between the 1st of September and the 1st of October, when an average of 150 cars are iced in the course of 24 hours. All told, more than 40,000 cars are iced at Alexandria in a twelvemonth.

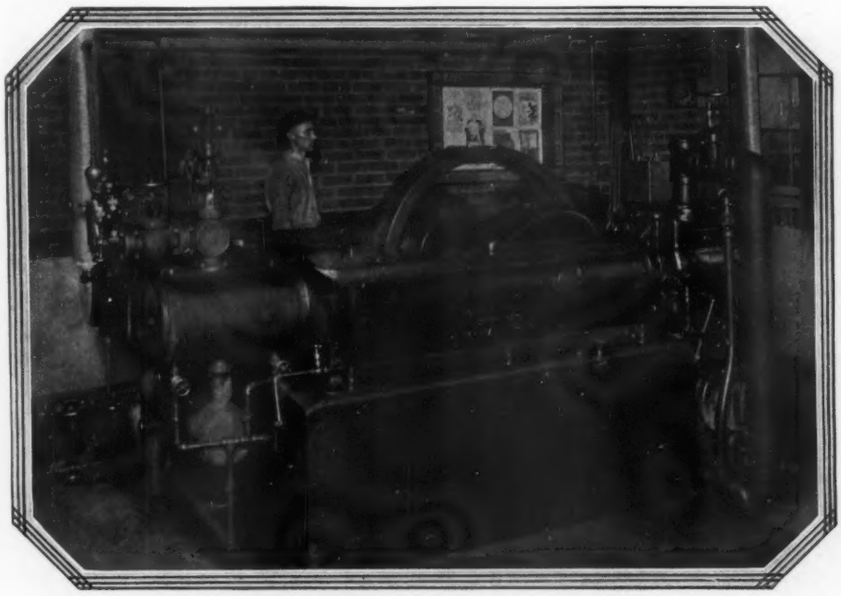
This icing is not, as it once was, more or less optional with the common carriers. Too much money and the health of too many people are concerned in this service. Therefore, the Interstate Commerce Commission has ordered that no car shall be permitted to leave the yard on its northbound journey unless the car carries at least seven-eights of its full supply of ice. This provision insures the presence of sufficient ice to keep the foodstuffs in a proper condition during the next stage in their journey. To be exact, the cars have to be iced once every 24 hours while loaded with perishables.

The fruits and vegetables arriving from the South to be distributed westward as far as Pittsburgh, northward to Canada, and eastward to Maine, not infrequently reach Alexandria in bitter winter weather and during a driving snowstorm. Most of the re-icing is done after nightfall; and it is at first hard to realize that the men struggling on the slippery tops of the cars in zero weather, and in the semi-gloom of flickering lights are toiling so that favored persons elsewhere may have grapefruit for breakfast or green peas and strawberries for dinner. It is thus that the refrigerator car has turned our normal seasonal dietary topsy-turvy and has made it possible for Americans to enjoy the year round the abundance of a ceaseless summertime.

The re-icing is done at the Potomac Yard by the Mutual Ice Company of Alexandria, whose plant is conveniently located for that purpose. The company has been in business since 1900 and was organized in the first place to manufacture ice for domestic use in the town. It was originally equipped to make ice by the absorption process. The present plant was built in 1913, and equipped to turn out 60 tons of ice daily for the Alexandria market. From time to time the plant has been enlarged until its capacity was raised to 240 tons. Plans are now in hand to augment this output to 400 tons daily. Of the total production, less than 20 per cent. is sold for household use—the remainder being employed to re-ice refrigerator cars. The plant has an ice storage capacity of 9,000 tons.

The Mutual Ice Company is able to ice 125 cars at a time. About 5 tons of ice are put in a car at its initial icing, and at each re-icing en route it receives 1½ tons of ice. A re-icing operation takes on an average 90 seconds for each car. This rapid work is made possible by an arrangement of double platforms—the only installation of its kind in the country. Each platform is 1,500 feet long; and the two platforms are said to be the longest icing decks in service. The

This compressor provides operating air for various purposes throughout the plant of the Mutual Ice Company.



The compressor which supplies the air required for operating the air lifts which bring the water to the surface from a depth of 282 feet.

platforms receive their ice from the storage rooms by way of a bridge that links the ice plant with the decks. At the outer end of the bridge there are pneumatic elevators which lower the ice to the deck level and there dump the cakes where they will be picked up by electrically driven chain conveyers—one of which is located in the center line of each platform of this island type of icing station. The conveyers move at the rate of 100 feet a minute. The workmen on the platforms have only to slide the cakes sidewise from the platforms and to drop them into the open hatches in the roofs of the cars. Even so, it requires practice and sure-footedness to do this work well and without mishap.

The present ice-making equipment in the plant of the Mutual Ice Company consists of one 125-ton and three 60-ton ammonia compressors. Compressed air is employed for agitating the water in the four 60-ton ice tanks; and for this purpose the plant has an XPV 14x6-inch duplex, low-pressure compressor. The water used in the plant is obtained from two wells, each 282 feet deep. This water is raised by air lifts; and the water supply is to be increased by the sinking of two more wells. Some idea of the volume of water circulating in the plant can be gathered from the fact that the quantity is greater than that handled by the municipal pumps, which furnish water enough for a population of 20,000. Compressed air for operating the air lifts, the pneumatic elevators at the icing platforms, etc., is furnished by three compressors: one 10-inch X-1, one 12-inch X-3, and one FR-1—all of them Ingersoll-Rand machines. The plant is also provided with a No. 9 surface condenser, with steam jets; and a Cameron pump handles the condensate.

As already mentioned, the daily output will be raised to 400 tons of ice by installing an electrically driven ammonia compressor rated at 150 tons' capacity. One new tank room will take care of this increased capacity. The cans used in the tanks produce 300-pound cakes; and the ice is clear and of excellent quality because the freezing water is continuously agitated by jets of compressed air.

The Mutual Ice Company is one of Alexandria's big industries; and because of the nature of its activities the company has a far-reaching effect. While most of the icing is done on cars northbound, still a measurable amount of icing is done in the case of cars loaded with perishable foodstuffs originating in the North and destined for the South. This is especially true of fish, meats, and other foodstuffs which find a ready market in the Southland at certain seasons of the year—so much for the interchange or reciprocal benefits made possible by manufactured ice and the use of refrigerator cars.

It is more than likely that George Washington, were he living today, would have been among the first to promote the manufacture of ice by present-day methods and to urge its use for the common good—exemplifying by this initiative the spirit which inspired him to send to Alexandria fresh and toothsome produce from his well-managed acres at Mount Vernon.

NOTABLE REDUCTION IN INDUSTRIAL WASTE

WE have succeeded in bringing about, in the course of half a decade, a very significant transformation in our economic life. This, in substance, is one of the outstanding pronouncements made by Secretary Herbert Hoover in his latest annual report. This, in the main, is due to what has been done on a national scale in lessening waste in many departments of industry.

While the Department of Commerce does not lay claim to credit for this economic achievement, still credit is due to the Department for what it did towards helping to organize a definite public movement in the direction of the elimination of waste. Business men, industrial leaders, engineers, and workers have responded on a splendid scale, and the entire country has benefited.

Speaking of the campaign that has brought about this tremendous change for the better, Secretary Hoover says: "The philosophy that underlies it has but one purpose: that is, to maintain American standards of living for both workers and farmers, and to place production on a more stable footing. The high standards of living enjoyed by the American people are the result of steadily mounting per capita productivity. There is only one way to further advance these standards, and that is by improved methods and processes, and by the elimination of waste in materials and in motion in our production and distribution systems."

Manifestly, there is room for enormous savings in numerous branches of industry by a still wider use of time-saving and labor-lightening machinery and tools; and, happily, the disposition to take advantage of these facilities is becoming more and more pronounced.

One of the air-lift wells from which the Mutual Ice Company of Alexandria obtains its pure water.

Portable Compressor Unwaters Flooded Quarry

By A. L. MURPHY

THE usefulness of portable compressors is now so widely recognized that it would be a waste of words to enter into an elaboration of their merits here; but the following account of a valuable service rendered by one of these units in an emergency strikingly emphasizes the adaptability of portable compressors and their availability for use when once they have arrived at the scene of activities.

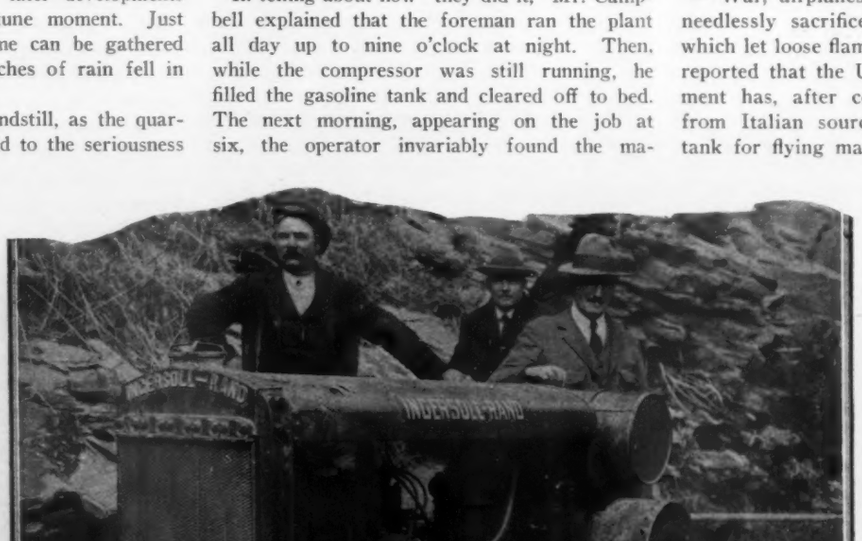
A section of the slate quarry at Clynderwen, Wales, after it had been unwatered by means of the air-operated steam pump.

For the purpose of operating "Jackhamer" rock drills and other pneumatic equipment, the management of the Tirch Rustic Slate Quarry at Clynderwen, Pembrokeshire, Wales, purchased a Type Twenty portable compressor. The machine arrived at the quarry during a spell of very wet weather and, as later developments revealed, at a very opportune moment. Just how wet it was at the time can be gathered from the fact that 7.43 inches of rain fell in Clynderwen and vicinity.

Operations were at a standstill, as the quarry was flooded; and, to add to the seriousness of the situation, the pump that was relied upon to drain the quarry was likewise flooded. What was to be done? Work had to be resumed as soon as practicable; but how to get rid of the water? And then it was that the quarry manager, Mr. P. E. Campbell, had an inspiration.

There was an old steam pump on the property; and, with a portable compressor available, why not use the compressor plant to operate the pump? The pump was promptly connected to the portable, which was capable of maintaining a steady pressure of 40 pounds at the pump. Day and night, the portable was called upon to furnish energy to drive the steam pump until, after almost a week of uninterrupted service, the quarry was unwatered.

In telling about how "they did it," Mr. Campbell explained that the foreman ran the plant all day up to nine o'clock at night. Then, while the compressor was still running, he filled the gasoline tank and cleared off to bed. The next morning, appearing on the job at six, the operator invariably found the machine still running and, again, filled the gasoline tank. This went on for the better part of a week until the quarry was drained. In conclusion, Mr. Campbell remarked: "I certainly think this proves the 4¼x4 Type Twenty a success."



The 4¼x4-inch portable compressor which provided the air to drive the pump that drained the quarry pit. Mr. P. E. Campbell, quarry manager, is at the right, while Mr. David Williams, foreman mechanic, is standing at the left.

To keep pace with the demands of the electrical industry, the United States Bureau of Standards is expanding its facilities to measure potentials as high as 350,000 volts—an undreamed of voltage only a few years ago.

NEW TANK LESSENS AIRPLANE FIRE HAZARDS

TIME and time again during the World War, airplanes were destroyed and lives needlessly sacrificed by bullet-pierced tanks which let loose flaming gasoline. It is credibly reported that the United States War Department has, after convincing tests, purchased from Italian sources a type of bullet-proof tank for flying machines.

The novel, self-sealing tank consists of two concentrically arranged cylinders, between which there is interposed a packing of cork. When the tank walls are pierced by a bullet, an electrically operated mechanism revolves the inner cylinder through a sufficient arc to cover the openings, thus promptly arresting the dangerous escape of gasoline. The purpose of the interlining of cork is to reduce friction so that the inner cylinder can rotate freely when so desired and not be bound by corrosion which might develop on the neighboring metal surfaces. It is also claimed that the tank will lessen the likelihood of fires.

Roadbuilding in Mountainous Kabylia

By MAURICE GLOERFELT

KABYLIA occupies a section of northern Africa extending along the Mediterranean from Algiers to Bougie and reaching inland to the Djurdjura Mountains—the highest of which rise to an altitude of 7,558 feet above sea level. Kabylia is one of the world's little known regions; and the inhabitants indicate a commingling of races that for the most part are of Caucasian origin and quite distinct from the blacks who generally people the Dark Continent.

The Kabyles are a branch of the great Berber race; and physically they are not unlike the Arabs of Algeria inasmuch as both the Arab and the Kabyle are white when born but are quickly bronzed by the sun. Generally, the Kabyles, like the Arabs, have brown eyes and wavy hair of a dark-brown or jet-black hue. However, certain of the Kabyles of a purer type have fair skins, ruddy complexions, and blue or gray eyes. This strain of the people marks a survival of the white pioneers that invaded Africa in the ages gone.

A Kabyle, equipped with an American air-driven rock drill, at work on the precipitous face of the mountainside.

It seems that the Kabyle is an energetic, enterprising body who may be found far from his birthplace working in any field of labor that will enable him to earn, in time, sufficient funds wherewith to buy a small plot of ground in his native village This done, the Kabyle lives upon the land and follows the settled life which has characterized his people for a long while. Because of the colorful life of the Kabyles and the decidedly picturesque nature of much of the country occupied by them, Kabylia has many attractions for the tourist; and many of these visitors to North Africa are easily induced to journey into the hinterland lying back of the seaports of Algiers, Dellys, and Bougie.

It is a common practice with tourists, after they have been to the towns of the south—such as Bou-Saâda and Biskara—and have traveled across the sandy stretches still farther to the south, to go thence to Kabylia, or at least to that part of Kabylia which can be most easily reached. There, they visit Tizi-Ouzou, Fort National, Michelet, and Bougie, where the land is made beautiful by the presence of luxuriant vegetation. But there is a part of southern Kabylia that is not so frequented because of the generally impassable or difficult roadways. This has been especially true of the approaches to Bouira and Maillot in the neighborhood of the mountainous country that culminates in the peak of Lella-Kadidja, which is covered with snow throughout eight months of each year.

Heretofore, this section of the Djurdjura has attracted only very good walkers and mountain climbers. The nearest approach to roads have been mountain trails over which sure-footed mules have been used to carry tourists. Such being the case, the general government of Algiers wisely determined to build a road on the slopes of Lella-Kadidja, linking Bouira and Maillot and tapping the northern part of Kabylia. This road, which is now in course of construction, will be finished during the current year. Progress has been hampered by the fact that weather conditions make it possible to carry on work during only four or five months of a year. The road force has been provided with a portable compressor and air-driven rock drills so that the men could more readily drill and blast out the mountainside. With these modern facilities they have made excellent headway; and the road, when finished, will prove a boon to the traveler and a means of opening up a region of impressive beauty.

Kabylia is well populated, and next to the Department of the Seine, in France, is more thickly settled than any other of the French territories. For the most part, the Kabyles live among the mountains, and their villages are situated upon the dominating ridges. Some of these communities extend for distances of from 7 to 8 kilometers; and each of them is managed by a group composed of several old people who administer justice agreeably to their customs and according to their lights. The queerest of these customs are those that have to do with the rights of women or, rather, with their lack of rights. The laws under which they live are called *kanouns*, and it may be of interest to mention how they affect the Kabyle woman.

By dint of much pulling and pushing, the portable compressor has been moved up and along the sloping shoulder of the mountain.

The Kabyle woman has no hereditary rights; she can own no property except her clothes. She has no choice in the selection of a husband: she is sold into marriage by her father or, if he be dead, by her nearest male relative. Her consent is not asked; and,

should she prove reluctant or rebellious, the tie can be imposed by force. She cannot of right ask to be divorced, but she can leave the conjugal residence and take a stand against her husband. However, this is not in itself sufficient to break up a happy home, because the husband can have several wives—and one more or less man concern him little.

A husband can repudiate any of his wives without giving a reason for his action; and when he does repudiate a wife he can put a certain sum of money "on her head." In that case, the woman can be married to another man only if the second man is able to pay the price previously fixed by the first husband. No claim made by a woman is of legal force. The children belong to the father. When the man dies, the woman is part of the succession and is transmitted in much the same manner as is the money or the furniture belonging to the estate of the deceased. As the *kanouns* express it: "You can do with your wife what you will."

The Kabyles are of a hospitable nature; and the manner in which they receive a visitor in some of the villages is rather curious. If the visitor is declared to be God's host, he is received at the *Djemâa*. He is not obliged to give his name, and he can leave when he likes without fear of molestation. If he accepts this unique distinction, he is welcomed into one of the village families with the right to choose from among the women of the house the one he likes best. While the Kabyles are kindly disposed generally, nevertheless they are revengeful towards their enemies and make their foes pay with blood. This spirit of revenge or vendetta often divides families and tribes.

Fortunately, many of the customs mentioned are disappearing little by little, and increasing numbers of Kabyles go to the big schools. Today, educated Kabyles are conspicuous as doctors, barristers, engineers, etc.; and some of them are in France, in Belgium, and elsewhere pursuing various professional or commercial callings. When abroad, Kabyles often are not known as such except among their most intimate acquaintances. Outwardly, there is nothing to distinguish the Kabyle save the small cross which is frequently tattooed in the middle of his forehead.

There are grown annually in the United States approximately 34,000,000 boxes of oranges, or more than half of the world's yearly production.

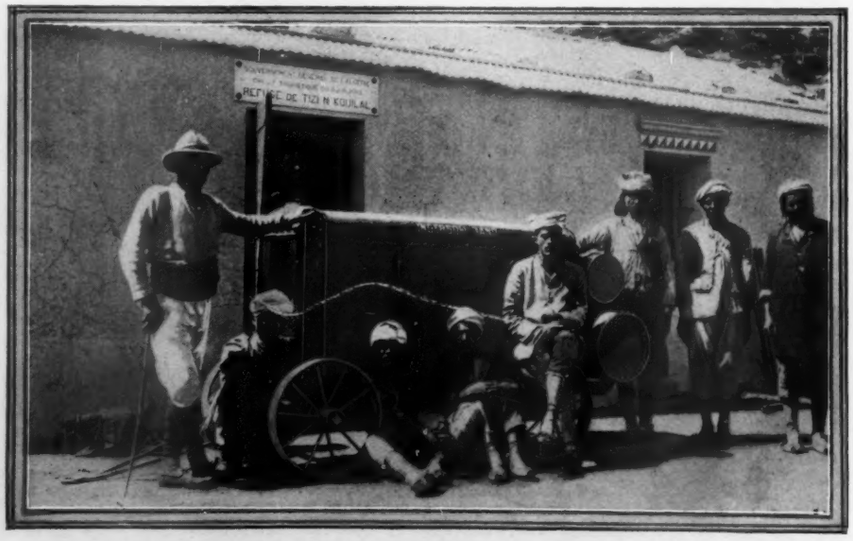
On the slope of Lella Khadidja, the highest of the Djurdjura Mountains in Kabylia, the Algerian government is building a road from Bouira to Maillot. This road can be seen extending across the picture just below the center.

DEEPER AERATION OF THE SOIL DESIRABLE

THE agriculturist is more and more inclined to regard himself akin to the manufacturer and to avail himself of the systematic methods and even of some of the working tools of the mechanical trades. The practice of "cultivating" growing crops by loosening the soil around their roots, so as to enable the roots to spread and, more especially, to put them in touch with the air, is on the increase.

The hand-held rock drill of the miner—the "Jackhamer," which is also the prototype of the railroad tie tamper and of the paving breaker—is now being utilized to advantage by the more advanced of the orchardists for the purpose of more deeply aerating the soil. For this work, a pointed, hollow steel bar is driven into the ground to a depth of several feet. The drill is then disconnected; an air hose is attached to the steel; and compressed air under considerable pressure is forced into the soil. This has the immediate effect of loosening the earth over a considerable area.

It is claimed that great improvement in the physical condition of the soil results from this method of aeration; and large orchards of earth-bound trees can thus be quickly and thoroughly treated beneficially.



Air for driving the rock drills is furnished by a 5x5-inch portable compressor which has been moved forward as roadbuilding advanced.

MEXICO EMBARKS ON BIG IRRIGATION PROJECT

THE Mexican government, according to newspaper reports, is intent upon embarking on irrigating projects that will make available for agriculture something like 1,500,000 acres. The work, if carried to completion, will call for an outlay of substantially $30,000,000 in the course of three years.

American engineers will take an active part in the directing and the planning of the several undertakings contemplated; and active operations are scheduled to begin about March of the present year. The intention is to build a number of large dams and to construct other works essential to the impounding and the distributing of the water. While some of the lands in question are already partly irrigated, the object is to amplify the existing irrigating facilities and, furthermore, to make available areas which are now virtually wastelands.

RAILROADS TESTING RADIO

ACCORDING to a pamphlet issued by the New York Central Lines, American railroads are alive to the potentialities of wireless means of communication. It seems that extensive tests with the radio, with a possibility of ultimately adopting it for practical uses in certain phases of railroad communication, are being conducted by the railroads. So far, attention has been directed principally to the development of a wireless-telephone set that will bring both ends of freight and passenger trains into communication and also to a means of enabling railroad-owned tugboats and other harbor craft to keep in communication with the central offices without making it necessary for the boats to dock each time.

The interest of the carriers in radio communication has been intensified by the development of railroad transportation in recent years and by the need of eliminating as far as possible any delays in the movement of traffic.

Impracticability of Winter Construction a Myth

By THE STAFF

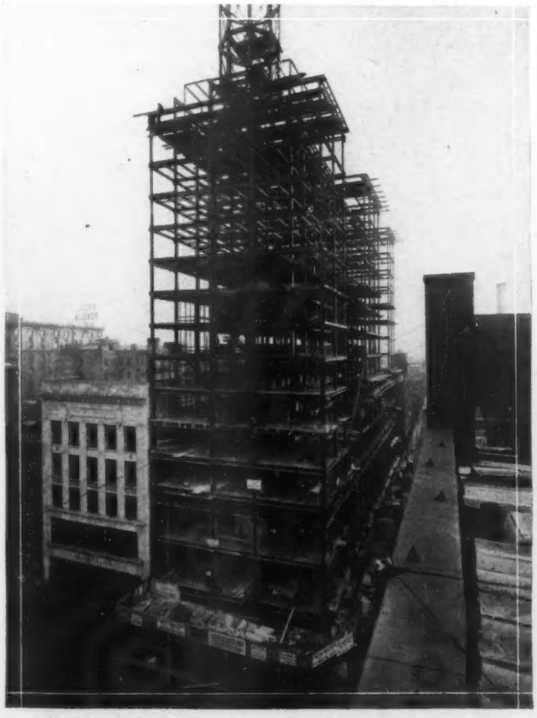
THE slowing up and, in many instances, the cessation of building operations during the winter months have been common occurrences in times past because of the prevailing belief that the severity of our northern climate precludes an efficient continuance of work. The fallacy of this belief is proved by the many operations that are carried on by some of the largest building contractors not only in New York but in cities where it is customary to see the mercury hovering around the zero point for three and four months of the year.

Breaking ground in the dead of winter for a building foundation. An I-R compressor and drill at work regardless of snow and ice.

Construction work can be carried on throughout the whole of a winter season, thanks to methods and facilities available today for that purpose. Inasmuch as there is now no reason why building operations should be suspended during the wintertime, the objection to work during the cold months can be disposed of through education. With this done, it should be possible to eliminate the hitherto non-productive period of the year and to assure a new and a much more prosperous era for the building trade as well as for all the contributing trades.

Special efforts are being made by the New York Building Congress to dissipate common misunderstandings about winter work, and to this end a number of architects, engineers and builders contributed, at a recent meeting, a clear picture of the true state of the problem and revealed how easy it would be to carry on building the whole year through. The first speaker, Mr. Alexander B. Trowbridge, President of the Architectural League, brought out that building operations in winter were being carried on successfully not only in New York and cities with similar weather conditions but even in Canada, where the climate is a much more severe one. For instance, one building in Canada was erected while the average temperature was 27° below zero Fahrenheit. The columns and the floors of this reinforced-concrete structure, which is of the mushroom type, were built simultaneously. To combat the intense cold, the workmen were protected by tarpaulins placed around the sides so as to enclose the floor space where operations were going on. As a further aid, the concrete was preheated and poured through tubes, and the molds were sheltered from the cold air by covering them with tarpaulins. A real difficulty was encountered in the occasional blocking of the tubes due to the freezing temperature. To obviate this, a steam pipe having several outlets was placed in the tube; and by discharging live steam from that tube whenever required a continuous flow of concrete was assured.

Among other examples of construction work under very trying winter conditions were the recent building of the Lake Placid Club,



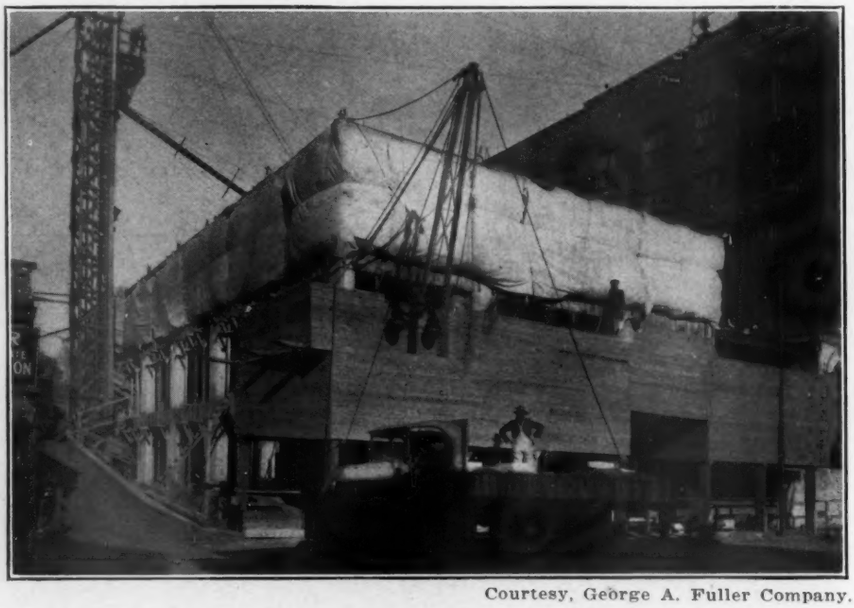
The Lincoln-Alliance Bank in the early stages of construction. Much of the building material was stored between floors so as to protect it from inclement weather.

Courtesy, George A. Fuller Company.

The bank building as it appeared in midwinter. The tarpaulins seen in the picture protected the workmen from the cold.

in the Adirondacks, and the erecting of a large hotel at Lake Louise, in the Canadian Rockies. The progress of these undertakings was never interrupted, as the sections under construction were at all times sheltered by wooden enclosures.

Mr. G. Richard Davis, a New York City contractor whose company is doing a great deal of winter construction, stated that winter work would not involve increased cost if practical ways of protecting the workmen were employed and a supply of materials secured several months in advance of their use on the job. In referring to a particular steel and cinder-concrete building, erected by his firm in 1924, he called tatention to an ideal method then practiced. While other operations were at a standstill, his company did not lose a single working day. Indeed, the only delay experienced was caused by the tardy delivery of some of the material, due to snow and ice on the city's thoroughfares. However, a great deal of the material had been secured in advance, and spaces set aside in which to store it during the bad weather. Tarpaulins and salamanders protected the concrete from the cold until it had passed through the critical period of initial setting. By placing a canopy of tarpaulin over the workmen it was possible for them to carry on even in stormy weather. Strange to say, some difficulty was met with in trying to convince the mechanics that work could be done on severely cold days. But when they realized the efficacy of the protective measures—such, for example, as setting window frames and sashes and covering them with muslin in lieu of glass, and introducing temporary heat as soon as the boilers were available—their doubts were dissipated.



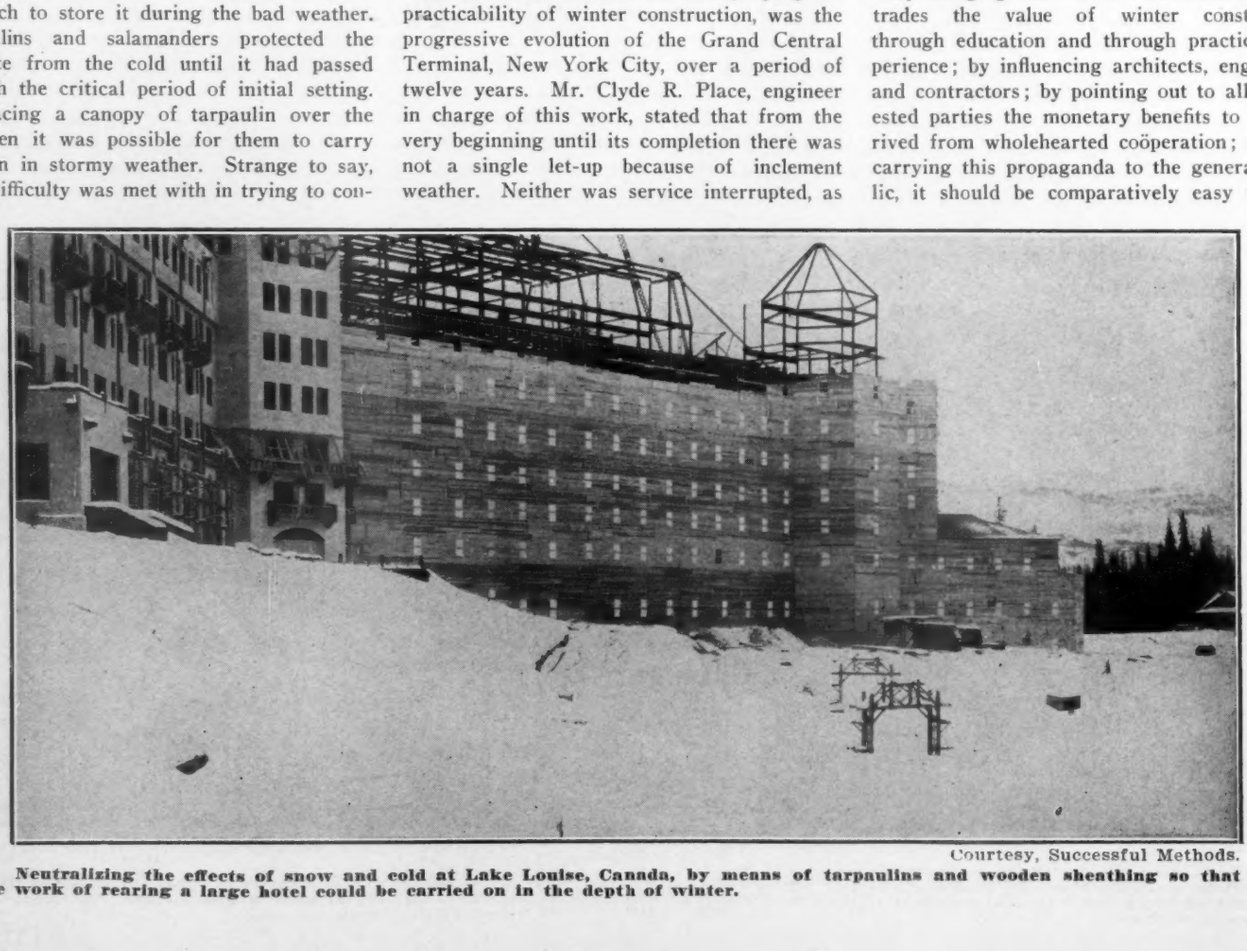
Courtesy, George A. Fuller Company.

A winter's day in Hartford, Conn., where work on the Hotel Bond was in no wise interfered with because of cold weather.

Another instance cited as exemplifying the practicability of winter construction, was the progressive evolution of the Grand Central Terminal, New York City, over a period of twelve years. Mr. Clyde R. Place, engineer in charge of this work, stated that from the very beginning until its completion there was not a single let-up because of inclement weather. Neither was service interrupted, as "all trains were supplied with water, heat, and light, and left on time both summer and winter." Mr. Place, in the course of his discussion, emphasized the fact that boilers and radiators can be installed permanently in the early stages of construction—by so doing saving the expense of temporary heating apparatus.

Although the most important phase of the satisfactory prosecution of winter building is the protection of the workman, there are other matters that must be considered. The mechanical installations of any large project fall under four heads: those having to do with heating and ventilating; with plumbing; with electrical equipment; and with the elevators. And to insure success there should be a real spirit of coöperation among the several trades engaged in these interrelated departments of the undertaking looking towards the use of permanent rather than temporary equipment wherever practicable.

By bringing home to the workmen and the trades the value of winter construction through education and through practical experience; by influencing architects, engineers, and contractors; by pointing out to all interested parties the monetary benefits to be derived from wholehearted coöperation; and by carrying this propaganda to the general public, it should be comparatively easy to win



Courtesy, Successful Methods.

Neutralizing the effects of snow and cold at Lake Louise, Canada, by means of tarpaulins and wooden sheathing so that the work of rearing a large hotel could be carried on in the depth of winter.

over the final arbiters, that is, the builders and the capitalists.

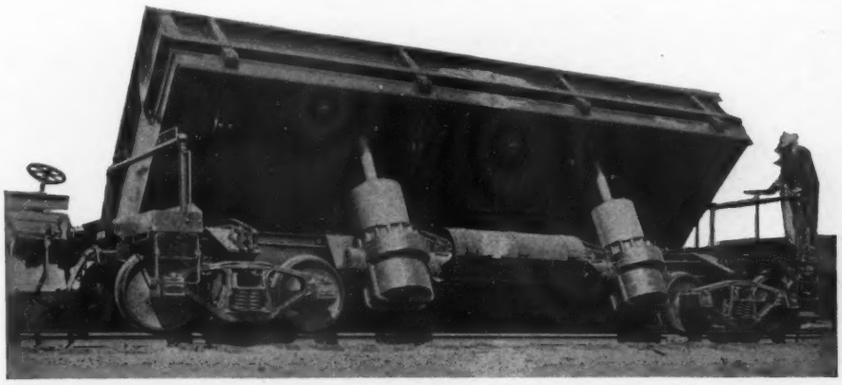
Mr. F. W. Fleisheim, President of the Master Builders Company, speaking from the viewpoint of the material man, no doubt voiced the thoughts of each member of the Building Congress when he remarked: "There is a common cause in the building fraternity, and that is to popularize the idea of winter construction with the building public. We can do that if architects, engineers, builders, contractors, and building-material men will coöperate towards getting the man with the money, the man who is interested in building, to do his building in the wintertime, erasing from his mind that old superstition that winter building cannot be done as easily, as cheaply, and as well as summer building. When we have done that we will have accomplished our purpose."

NEW TYPE OF AIR-OPERATED DUMP CAR

THE Differential Steel Car Company, of Findlay, Ohio, has recently developed a type of dump car that makes use of the power of compressed air for its operation. The manufacturer claims that this car not only embodies the good points of former designs but that it has the following additional desirable features: low height; capacity to place the material clear of the tracks; and the elimination of a locking mechanism.

The low height—7 feet 4 inches from the top of the rail to the top of the side board—insures a measurable increase in stability and also facilitates loading the car. And as the body is made to rest on four points directly over the bolster side bearings, the stability of the car is increased to such an extent that the need of the usually troublesome locking mechanism is done away with..

The car is provided with two down-folding doors—one on each side, so as to permit dumping in either direction. These doors operate automatically and, when dropped, form chutes that extend an appreciable distance away from the rails. This makes it possible to dump the contents clear of the rails and to prevent earth, rock, etc., from falling on the tracks. Furthermore, when unloading, suitable sector plates hold the material in place so that it cannot slide out at the ends of the doors and foul the ballast.



Dump cars of this type are equipped with four pneumatic cylinders—two on each side—which make it possible to empty the cars on either the right or the left side of the track.

Each truck has four air cylinders—two on each side, as shown by one of our illustrations. When the air valve is turned to the left, compressed air is fed to the cylinders on the right; the upward movement of the pistons in those cylinders tilts the car; and the load is dumped to the left. These operations are simply reversed when it is desired to place the material on the right-hand side of the track. The air supply may be taken from the air-brake train line without setting the brakes; and each car carries an air tank of sufficient capacity to assure the quick and certain dumping of its load.

Because the dumping action is an upward and outward one, the contents, instead of just sliding out of the car, are thrown some distance away from the track. This is accomplished without shock either to the car or to the track structure by employing a suitable method of cushioning at the termination of the dumping operation. The angle of discharge is approximately 50 degrees, and this is considered steep enough to rid the car even of heavy, wet clay.

These new air-operated dump cars are manufactured in two sizes: the larger is 38 feet 7 inches long and has a capacity of 30 cubic yards, while the smaller one is 31 feet 10 inches in length and is capable of carrying 24 cubic yards of material.

This low-height dump car is capable of carrying a crown load nearly 50 per cent. greater than its rated full load.

A GIGANTIC MUFFLER FOR DIESEL ENGINES

SIX Diesel engines, developing in all 4,500 H.P., were recently installed in an industrial plant at El Paso, Tex. The combined exhausts from these engines caused a noise that could be heard within a radius of 3 miles. To remedy this, a large corrugated-iron muffler was made measuring 36 inches in diameter and 104 feet long. A 50-foot stack was also built for use in connection with the muffler.

In service, the exhaust from each engine is so timed to enter the manifold that one exhaust counteracts the other, thus tending to lessen the sound. As an added feature, a heater was placed between the manifold and the stack so as to utilize the heat of the exhaust gases which range in temperature from 600° F. to 800° F.

LINERS TO CARRY 'PLANES TO SHORTEN VOYAGE

TWO new ships that will ply between the United States and certain Mediterranean ports are to be equipped with facilities which will enable them to carry and to launch from their decks amphibean 'planes, according to a news dispatch in the *New York Herald Tribune*. The purpose of this innovation is to shorten the ocean voyage or to permit a passenger to hasten to a destination beyond the docking city.

The ships in question are the *Saturnia* and the *Urania*, each of 26,500 tons gross, and will belong to the Cosulich Line. The company estimates that, by using these 'planes, passengers will be able to shorten a voyage by quite two days. There will be an appropriate charge for this special service.

Water Supply Tunnel to Pierce 4,000 Feet of Granite

Rapid Progress is Being Made on the New Aqueduct of the National Capital by the Use of Compressed Air and Highly Efficient Rock Drills

By GEORGE H. DACY

ORDINARY air under pressure is operating modern machinery and tools that are being used to drive a tunnel through rock-ribbed strata down in the latitude of our National Capital not far from the august halls of Congress. In determining the line to be followed by a 9-mile conduit, designed to carry water to the City of Washington, exploratory borings revealed that a stretch of approximately three-quarters of a mile consisted of solid granite. As it was impossible to run the conduit over the granite barrier, and as there was no way of sidestepping it, it meant tunneling through the hard rock if the water-supply line was to be laid.

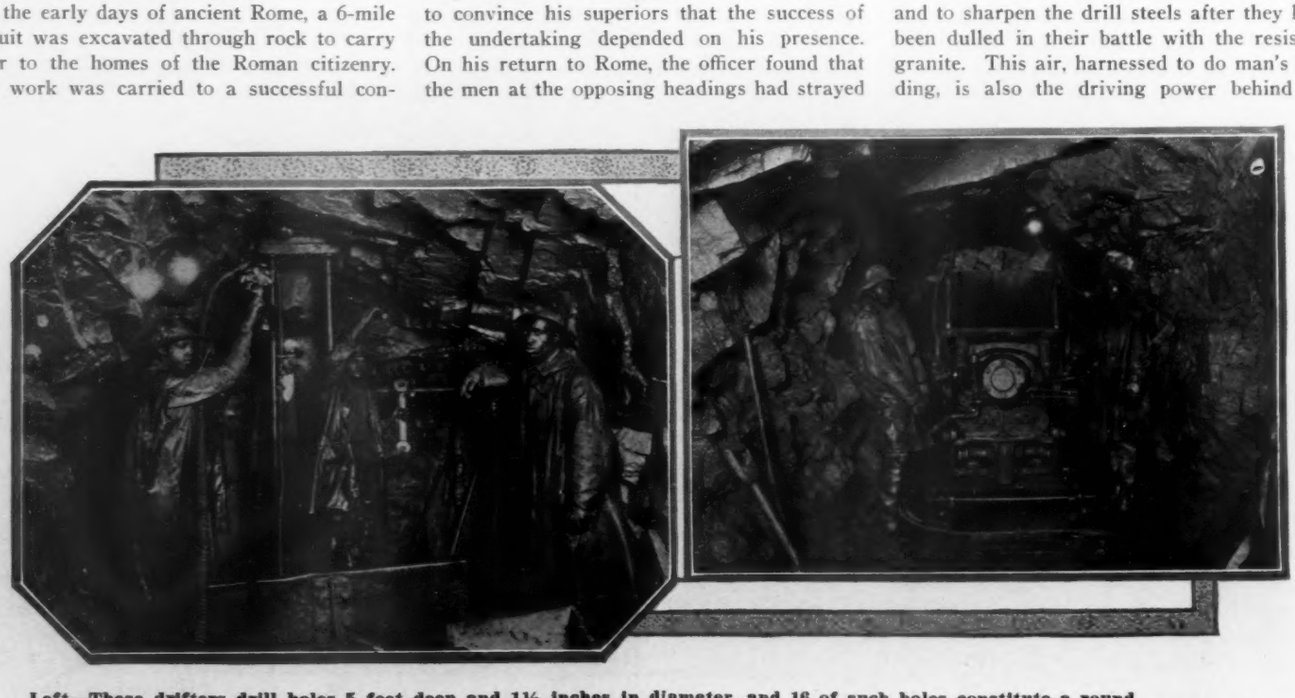
Washington, threatened for several years with an impending water famine, is spending $9,000,000 in the building of a thoroughly modern filtration and storage system. The mere opposition of a stretch of nearly 4,000 feet of granite was not sufficient to tie up the project for any length of time. Public bids were requested; and, of the several engineering contractors who figured on the job, the award for the rock tunneling went to Allen Pope, an experienced Washington engineer who does work in all parts of the world.

In the early days of ancient Rome, a 6-mile conduit was excavated through rock to carry water to the homes of the Roman citizenry. This work was carried to a successful conclusion by such primitive and laborious methods that we, accustomed as we are to the use of labor-lightening tools and equipment, cannot help but marvel that the aqueduct was attempted at all. In the first place, a narrow annular channel was cut in the rock by hand. This channel extended around the circumference of the potential tunnel. Next, wedges made of soft wood were driven at regular intervals into the cut and, with that done, the wedges were saturated with water. Now we can understand why soft instead of hard wood was chosen, as the greater swelling action of this wood was counted upon to exert sufficient pressure upon the rock to cause it to break. And so the work progressed month after month and year after year until the tunnel was finished.

As long as we are on the subject of this Roman undertaking, it might be interesting to mention here that by reason of the absence of the officer in charge of operations, the work almost resulted in two non-connecting lines instead of in one main tunnel. The engineer or officer, call him what you will, had been sent to Spain on military service; and it was only after weeks of argument that he was able to convince his superiors that the success of the undertaking depended on his presence. On his return to Rome, the officer found that the men at the opposing headings had strayed from the tunnel line—in other words, the headings had not met at the predetermined point. The error was located, and the headings were finally broken through.

Had the ancient Roman methods of tunneling been utilized by the Washington contractor, now engaged in driving the tunnel through the granite underlying the District of Columbia, the completion of this modern aqueduct would be postponed for a long, long period of years. As it is, the work is today being pushed forward with that speed which up-to-date facilities and compressed air make possible. With the equipment now at their disposal, air-driven tools enable the workers to do in a few minutes what once took the Romans months to accomplish.

Compressors furnish the air that operates the drifters used at the headings to drill holes for the charges of dynamite; that functions the mechanical shovels or mucking machines which remove the earth and rock after each shot; and that actuates the hoist employed to lift the shattered rock from the tunnel to a rock crusher at the surface. Compressed air is required to operate the oil furnace and the sharpening machine used to heat and to sharpen the drill steels after they have been dulled in their battle with the resistant granite. This air, harnessed to do man's bidding, is also the driving power behind the



Left—These drifters drill holes 5 feet deep and 1½ inches in diameter, and 16 of such holes constitute a round. Right—This type of air-driven mucking machine has proved highly effective in moving the broken rock and in loading the mucking cars.

chipping and the trimming machines utilized to finish off the walls of the tunnel after every blast.

Each of the two compressors has a capacity of 650 cubic feet of free air per minute, and the machines supply air at a working pressure of 100 pounds. From the compressors the air is delivered to an air receiver, having a capacity of 2,000 cubic feet, whence it is conveyed down into the tunnel by a main air line. By means of suitable hose connections, the air is then fed directly to the various pneumatic tools in use, to the oil furnace, the sharpener, the hoist, the concrete gun, in fact, to any and all points where its services are needed.

The blacksmith shop is equipped with an Ingersoll-Rand oil furnace and a "Leyner" sharpener so as to keep the drill steels fit for their work of penetrating the hard granite.

The work of tunneling is going forward from two headings—two gangs are proceeding in opposite directions from a shaft sunk midway on the tunnel line. By thus carrying on operations from a central base, the contractor is not handicapped by having to shift machinery and materials from one place to another. The main air line is lengthened as the tunnel advances and is carried to within 50 feet of each heading. From that point onward, armored hose delivers the air to the several drills at work at a heading.

The drifters employed on the job are of a type that has been especially developed to meet exacting conditions, such as are being encountered in the driving of the Washington water-supply tunnel. Anyone at all familiar with rock drilling knows that granite is exceptionally hard to penetrate. The R-72 rock drills, which are being used, are mounted on columns and are of the wet type. These drills are able to remove the cuttings from the bottoms of the drill holes and to prevent the generating of dust. By keeping the holes free from bits of rock, etc., the drills can exert all their force in cutting the solid rock.

The hollow, round, 1¼-inch drill steels are made of special Swedish steel and are from 2 to 10 feet long. And right here it might be mentioned that, because of the hardness of the opposing material, one of those keen-edged steels may need resharpening after drilling a hole anywhere from 1 foot to 1½ feet deep. On an average, 200 and more steels are sent to the blacksmith shop daily for reconditioning. After being heated to a temperature of from 1,850 to 1,900° F., in the oil furnace, the end of the steel undergoing treatment is placed in the die of the pneumatic sharpener and the crosshead lowered. Then, while being held in a vice-like grip to assure rigidity, a dolly suitably shapes and sharpens the bit and does the work almost faster than it takes to tell about it. By means of a shank and bit punch, with which up-to-date sharpeners are now equipped, it is possible quickly to open up the water hole in the steel if by any chance it has become clogged or closed. The maximum capacity of the equipment is 600 drill steels daily. Needless to remark, a blacksmith shop not so outfitted would be quite incapable of doing the same amount of work in the same time and at the same cost.

The tunnel is horseshoe shaped, and is 6 feet high and 6 feet wide at the base. The drill holes are bored to a depth of 5 feet. Ordinarily, a round consists of 16 holes placed at uniform intervals; but, occasionally, it is necessary to drill a larger number of holes to a round. The holes are loaded with from 33 to 40 pounds of dynamite and discharged electrically after the tunneling gang has retired to the safety zone, about 200 feet away from the heading. The shots at the opposing headings are fired alternately; and a mass of rock equivalent to the volume of a cylinder 5 feet long and 7 feet in diameter is brought down at each blast. The aim of the contractor, who is pushing the work along both night and day with three 8-hour shifts, is to fire at least one shot during each shift. Under the most favorable conditions, as much as 24 feet of tunnel is cut through the granite daily; but, on an average, the daily advance is anywhere from 10 to 15 feet.

After a drill has been sharpened, the axial hole in the steel is blown clear with compressed air.

A mucking machine, operated by compressed air, is employed at each heading to load the shattered rock into suitable cars. These cars run on a trackway, laid along the tunnel floor, and are hauled to the shaft by a small, locomotive type of tractor. At the shaft, the pneumatic hoist is used to lift and to dump the contents of each car into a bucket, which conveys the material to a chute which is placed at a height of 25 feet above the level of the street. The air hoist has a lifting capacity of 2,000 pounds when operating at the rate of 200 feet per minute. For work of this kind, air hoists are very satisfactory, as they occupy but little space. And in underground operations this matter of economy of space is one that must be considered. From the chute, the material flows by gravity to a rock crusher, where it is reduced to different sizes suitable for the making of concrete for the tunnel lining and for roadbuilding. Any surplus rock, that is, any rock not needed for aggregates, is sold and used in the construction and the repair of Washington streets and highways.

When the 4,000-foot stretch of the tunnel, which lies anywhere from 40 to 125 feet below grade, is cut through the granite, the concreting part of the program will begin. This work will be done in sections—that is, the floor is to be laid first, and then the side walls and the arch are to be lined by the aid of

portable metal forms. These forms will be shifted from point to point, as the work progresses, by means of cars pulled by a gasoline locomotive—the tracks for this line being run over the finished concrete floor.

The concrete mixing machine is located in a rock-walled niche about halfway down the shaft. The arrangement is such that the cement, sand, and crushed stone, properly proportioned, flow by gravity to the mixer. When the concreting is taken in hand, the material from the mixer will be fed to an air-operated cement gun that will not only deliver the concrete to the point of use but place it in the forms. This gun is to be set up at the bottom of the shaft. The lining is to be carried out in 15-foot sections, with joints of asbestos between adjacent sections to allow for expansion and contraction.

Ventilating air is delivered to the working faces through a special fabric pipe line, 16 inches in diameter; and a large electric fan, above ground, assures a continuous circulation of fresh air. The installation is of sufficient capacity to supply each workman in the tunnel with 25 cubic feet of air per minute. In certain parts of this section of the tunnel, timbering has had to be resorted to. As a matter of fact, 500 feet has so far been supported in this fashion in order to prevent loosened rock from falling before the concrete lining can be put in place. The underground workshop is lighted electrically; and current at 440 volts actuates the motors which drive the air compressors, the rock crusher, the concrete mixer, and the centrifugal pumps which drain the tunnel of any incoming water. Manholes will be provided at each end of the tunnel to facilitate the making of interior repairs should work of that nature be required in the years to come.

As has been mentioned earlier in this article, the use of air-driven tools are making it possible to drive the tunnel far more rapidly than would be practicable if the drilling were done by hand. This is readily appreciated when the reader is reminded that there is room enough at a heading for only four or five men to work effectively at one time. If the men had to drill all holes by hand and to load all broken rock by hand, the cost of driving the three-quarter mile tunnel through granite would amount to several million dollars and would take from 4 to 5 years to complete. By employing compressed air as a motive medium, the task will be finished in about 18 months and will involve an outlay of only $250,000.

Washington draws its water supply from the Potomac River at the Great Falls. A conduit, built before the Civil War, has served as the connecting link between the not infrequently turbid waters of the river and a slow sand-filter plant—a link 15 miles in length. The new 9-mile conduit is being run parallel with the original waterway, and will terminate at a thoroughly modern, rapid sand-filtration plant costing $2,500,000. Two new concrete storage reservoirs are also under construction. When the entire $9,000,000 water-supply system is ready for service, the National Capital will have at its disposal a daily supply of 170,000,000 gallons of purified water. This will more than double the supply of water which has heretofore been available, and will be enough to take care of the normal growth of Washington during the next 100 years.

COMPRESSED AIR LIGHTENS LUMBERMAN'S WORK

THE logging and lumbering industry is keeping pace with other modern industrial enterprises in the use of air-operated machinery. For example, in turning logs as they go through their first cutting, the so-called air-dog has been found to be the most effective tool that has so far been devised for the work. Of course, compressed air is being employed in various other ways about sawmills and lumbering camps; but the latest application to which air is being put is in speeding up the splitting of wood blocks or bolts, as they are familiarly known to the lumberman.

Air hammer fitted with a wedgelike tool for splitting large blocks or sections of logs.

The device employed for the purpose is called an air-wedge. It consists of a regular air hammer with the hammer end fitted with a steel wedge. Where it is in service, the practice is first to spot the block with the aid of a hoist, and then the hammer operator marks the line along which the block is to be split horizontally. As the air-driven wedge works its way into the bolt, the upper portion of the block is raised by the hoist to facilitate the entrance of the wedge and to prevent pinching. By thus letting compressed air do the splitting, it is possible for one man—without much physical effort—to do the work that formerly required the brawn of three men.

So satisfactory has been the operation of this new tool that its use is spreading; and it is no exaggeration to say that all sizable plants in the West, where it is now the custom to split large blocks by hand, will soon abandon that laborious method for the far more efficient one just described. For its successful operation, the air-wedge requires 56 cubic feet of air per minute at a pressure of from 80 to 90 pounds. Where a compressor plant is not available—that is, where air is not already being employed in one way or another about a mill, a portable compressor or a small stationary steam or electric unit can be counted upon to provide an adequate supply of air.

Petroleum is the most important mineral product of Burma.

COMPRESSED-GAS INDUSTRY

AT the last annual meeting of the Compressed Gas Manufacturers' Association—held recently in New York, attention was called to the magnitude and to the permanency of the industry represented by the association. Among the gases produced and distributed are: acetylene, ammonia, carbonic, chlorine, hydrogen, nitrous oxide, nitrogen, oxygen, sulphur dioxide, etc., etc.

These gases are used for lighting and heating; in the fabrication of metalwork by the welding and the cutting torch; in mechanical and local refrigeration; in charging beverages; for bleaching purposes in both textile and paper factories; for purifying water and sewage; as an anesthetic; as a fire extinguisher; and in numerous other ways.

The value of these gases annually consumed in the United States is estimated to be in excess of $60,000,000. Substantially all these gases must be compressed for transportation in tank cars or for storage in portable steel cylinders, of which there are 4,000,000 in service. These cylinders, alone, are worth $40,000,000.

Automobile Laundry the Latest of Conveniences

The Dirtiest of Cars Can Soon Be Made Spick and Span Again While You Wait

By H. H. STARKEY

TRULY, we are living in a marvelous age. If we desire to have our shoes shined and polished we do not do it ourselves as was the common practice not so many years ago. We go to one of a chain of shoe-shining emporia, where we incidentally receive another service—our hats cleaned while we wait. Mother does not bake bread at home as her mother used to do. Instead, she buys real "home-made" bread fresh from the ovens of a vast company that makes bread just as good as the domestic product, or, as a popular advertisement states: "Bread that 98,000 housewives taught them how to bake." Whoever, in this age of specialized service, hears of the family wash being done at home? A richly painted laundry car comes to your door to receive the family's soiled linen, and a day or so thereafter brings back the wash snowy white and neatly pressed.

Probably, following the same train of thought, the men who conceived the Klean-Rite Auto Laundry Company, of Chicago, put to themselves this query: "If there is a laundry for one's linen why not a laundry for one's car?" At any rate, they have recently materialized the idea, which, judging by popular demand, promises to become one of the largest specialized industries in the country.

The first Klean-Rite automobile service to be established in the East commenced operations a few months ago at 109 Montgomery Street, Brooklyn, N. Y., under the name of the Superior Auto Laundry Company. The partnership is composed of three Scandinavians, two of whom had been seafaring men forced to work ashore because of the dullness of the shipping industry. The third of the trio had been in the automobile-repair business for years—in fact, he was the only one of the group with previous experience in that field. While in the repair business, he was often asked to clean cars. While he did not care for this sort of work, having no facilities with which to do a thoroughly good job, he had, however, given the matter of cleaning automobiles much thought, and believed that compressed air would do the work in a satisfactory manner. To this end, he had priced different compressors. Indeed, he was about to purchase such a machine when he happened to read about the Chicago Klean-Rite Auto Laundry Company. After getting in touch with this firm, the partnership was organized by the three men already mentioned; 9,500 cubic feet of space was secured from the owners of a garage; and the Klean-Rite system was installed.

The Superior Auto Laundry is equipped with two cold-water tanks, each of which has a capacity of 540 gallons. Only one, however, is used at a time, although both of them are kept filled. Besides the two cold-water tanks there is another container, holding about 40 gallons. This is called the soap mixer. In the course of an average day's work from 10 to 15 pounds of soap are consumed. After the soap is placed in the tank a jet of hot water is admitted for the purpose of forming a lather. This mixture is then carried by pipe line into two tanks, the capacity of each approximating 150 gallons. From these tanks the soap solution is distributed to the working points by air at a pressure of 80 pounds. The air pressure is furnished by a single Ingersoll-Rand 5x4-inch compressor driven by a 5-H.P. motor.

In the cellar of the garage is a 250-gallon hot-water tank which is heated by an ordinary cylindrical coal stove. The stove originally employed furnished adequate heat for a while. But the increased business, resulting from the popularity of the Klean-Rite service, naturally demanded a greater amount of hot water, and, consequently, the proprietors had to substitute a larger stove. Indeed, on extremely busy days, when hot water is in continual use, even this stove is taxed to the utmost. The problem of maintaining a supply of hot water was solved eventually by an ingenious member of the firm, who constructed a pipe line from the air receiver to the stove and thus improvised a forced-draft system.

Left—Compressed-air gun used to spray an anti-rust solution on the rear springs of a car. Right—A car, over the pit, undergoing washing at the Superior Auto Laundry.

Left—Drying off a car with compressed air after it has been washed by the Klean-Rite system. Right—Compressed air is used to remove dust from the upholstery and the interior generally of a car.

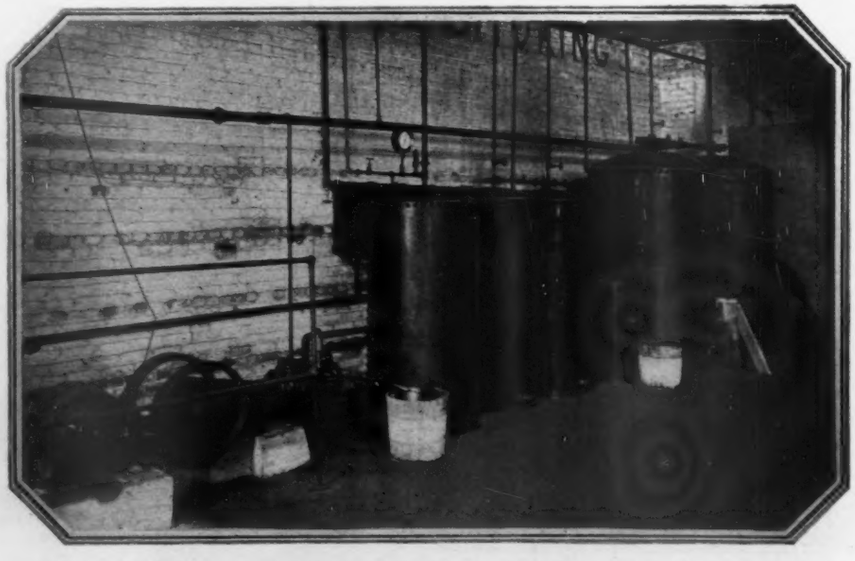
In watching operations at the Klean-Rite Auto Laundry, we are reminded somewhat of the familiar scene in a tonsorial parlor. In this case, it is not the man but the car which is "next." A car to be cleaned enters the portals of the garage, and is checked. The owner or driver is politely offered a comfortable wicker chair in which to wait at ease while his automobile is undergoing the various cleansing stages.

The first step in the process is a thorough cleaning of the inside of the car by compressed air. The top is dusted by hand. The automobile is then rolled over a pit. This pit is made of concrete and measures 18 feet long, 12½ feet wide, and extends 18 inches below the level of the garage floor. There is a concrete wall, 42 inches long and 10 inches thick, on each side of the pit. Embedded in these walls are 8 square flood lights, 4 on each side, which thoroughly illuminate all parts of the car standing on the runway over the pit.

The washing of the car is ordinarily done by two "pitmen"; but when business is brisk four men are engaged. At two points on each side of the pit four pipes converge and terminate in single connections. One of these pipes delivers cold water, drawn from the city main; another is a hot-water-feed pipe connected directly to the tank in the cellar; the third furnishes the soap solution; and the fourth pipe is the compressed air line.

With these facilities at hand, the procedure in the pit is as follows: First, the soap-solution valve is turned on, and the chassis and sides of the automobile are thoroughly lathered. Everything is reached—rear axle, mud guard, housing, running gears, front apron, steering knuckle, rear bumpers, etc. Should additional force be needed to wash a particularly dirty part of the car then the air valve is cracked, and this slight increase in pressure behind the cleansing fluid suffices to loosen and to remove the dirt. When hot or cold water is used to thin the soap mixture, the cleansing action is improved by applying compressed air to increase the force of the spray. A "kerosene gun," devised by one of the firm, is found to be effective in cleaning the motor—the kerosene being ejected in the form of a fine spray by means of compressed air. The atomized kerosene reaches and cleans crevices and hidden parts where soap-and-water washing would be ineffective.

With two men to do the cleaning, only seven minutes are required from the moment the car is rolled over the pit until it is moved away to make room for the next one. Naturally, four men can do the work in half that time. When the car in hand has been pushed off the pit and rolled ahead about 15 feet, two men with hose lines are put on the job of washing it down with cold water at the ordinary pressure maintained in the city main. This rinsing takes two minutes. With this done, the car is pushed a little farther ahead. Two men, known as "chamoismen," now jump to do their part of the task. First, one of them uses compressed air to thoroughly dry the car—the air searching out all places where it would be well-nigh impossible to wipe by hand. Next, to balance their efforts, one man works on the inside of the car while the other rubs down the windows and the paintwork on the outside. When the chamoismen have finished, a nickel polisher comes along and gives the machine the final touches. The automobile is now ready to pass in front of the critical eye of one of the proprietors, who sees



Electrically driven compressor, air receiver, and tanks containing soap solution and cold water, forming part of the equipment of the Klean-Rite automobile washing system.

to it that everything is as it should be before the car is handed over to the chauffeur or owner. When the weather is not bad or threatening, from 40 to 50 cars are put through the laundry in the course of a day, but on Saturdays as many as 87 cars have been laundered.

Speaking about the rapid growth of the business and about the I-R compressor, the youngest member of the firm waxed enthusiastic and said: "From early morning till late at night, day in and day out, it not only has been steadily pumping an adequate supply of compressed air for the various uses to which air is put in the Klean-Rite system, but it has been pumping money into our pockets as well."

The analogy between the auto laundry and the barber shop is closer than one might imagine. Extras are urged on the automobile owner much in the same way as a barber recommends a shampoo, a massage, or a hot towel. One of these extras, which the Superior Auto Laundry is enthusiastic about, is the Kant-Rust lubrication mixture. This is employed wherever metal touches metal. A special gun, using compressed air to spray the oil solution, effectually does away with any squeaks caused by accumulations of rust. Other extras will probably be developed as time goes on.

After watching the Klean-Rite Auto Laundry in action, no doubt is left in the mind as to the success of the undertaking; and it seems certain that stations so equipped will become as common in the future as the familiar gasoline filling depots now are. The success of the auto laundry depends largely upon the effectiveness of compressed air and the cheapness of the machine that supplies that air. In all the plants installed by the Chicago Klean-Rite Auto Laundry Company the needful energy is furnished by 5x4-inch compressors.

Approximately two-thirds of the total population of India belongs to the agricultural class.

Cars awaiting their turn at the washing station.

SOCIETY GIVEN COLORS OF MILITARY ENGINEERS

ON THE 4th of last December, the colors of the 24th United States Engineers were presented to the United Engineering Society as a regimental memorial, and upon that occasion Mr. W. L. Saunders, as President of the United Engineering Society, made the following acceptance address:

"Colonel Whitlock and men of the 24th Engineers: On behalf of the Trustees of the United Engineering Society, I accept the custody of these colors of the 24th Engineers. They shall be carefully installed and exhibited in the halls of this building, there to remain as a permanent memorial.

"Yours was the first regiment of its kind to be organized in the Army of the United States. Never before had the value and aid of the engineers in war been so fully recognized. You built and maintained shops, cement-block plants, railways, pumping stations, lighting plants, buildings, hospitals, schools, camps, stables, and many other things so important in modern warfare. To the men in the trenches you were what the laboratory is to the chemist. Through such work as you did the World War was brought to an end.

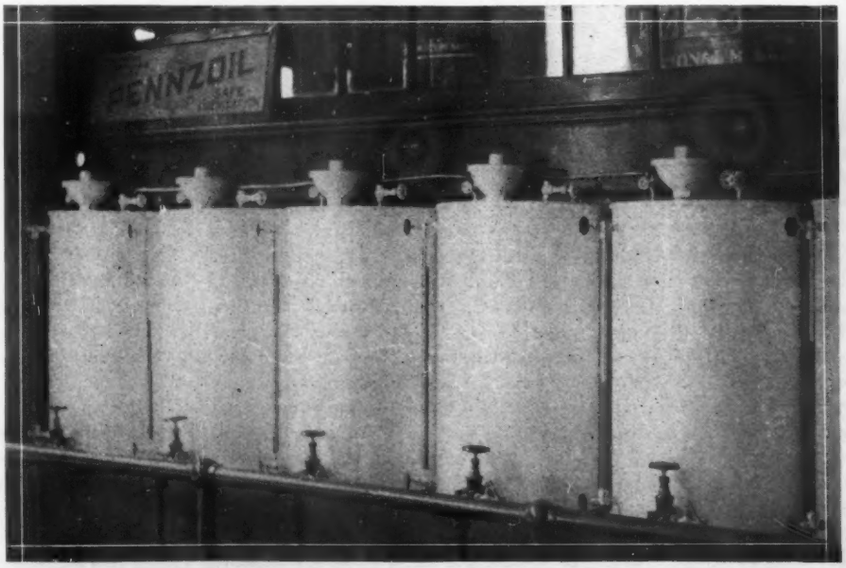
"And as future generations look upon these colors, they shall see in them not a cold monument of stone raised to a gallant warrior, whose example one might seek to follow, but a living reminder that strength in war is no longer a human but a material thing: that through machinery, industry, and engineering, a nation fully prepared in peace is likewise prepared for and insured against war."

SPECIAL TRAIN EXPLOITS AUSTRALIAN INDUSTRY

A TRAVELING exhibition on a train 1,000 feet long, painted white, and bearing in huge red letters the inscription "Buy Australian-made," is now on a 6-months' tour through New South Wales. The train left Sydney early in November, 1925; and the exhibition, which was organized by the Australian-made Preference League, is intended to impress on the residents, especially of the provincial areas of New South Wales, the importance of Australia's secondary industries and to stimulate the buying of domestic goods.

The train is said to be the largest that has ever pulled out of Sydney; and the engine, an Australian product, is the biggest of its kind in the Commonwealth. The cars are especially outfitted for exhibition purposes. Among other unique features, the train carries its own radio station, operating on a wave length of 850 meters, from which speeches and musical programs are broadcasted nightly.

In some of the larger cities, the arrival of the "Great White Train," as it is called, heralds an "Australian-made" shopping week. The tour, as originally planned, covers a distance of 2,300 miles; but it is now proposed to extend the itinerary and to take in the south coast of New South Wales. The total cost of the trip is estimated at $50,000.



These oil tanks, in a thoroughly up-to-date San Francisco garage, are so arranged that air pressure can be applied to them for the purpose of delivering their contents wherever the oil may be needed about the establishment. The compressed air serves to overcome any increased viscosity of the oils that may be induced by a chilling temperature.

Compressed Air Magazine

—*Founded* 1896—

Devoted to the mechanical arts in general, especially to all useful applications of compressed air and to everything pneumatic.

Business and Editorial Offices:

Bowling Green Building, No. 11, Broadway, New York City. Tel. Bowling Green, 8430

Publication Office: Somerville, New Jersey

TERMS OF SUBSCRIPTION

$3 a year, U. S. A., American possessions and Mexico; all other countries $3.50 a year, postage prepaid. Single copies, 35 cents. Back issues more than six months old, 75 cents each.

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EDITORIALS

THE UBIQUITOUS RADIO

MANY a martyr to business has sacrificed his final defense of privacy by putting a telephone in his bathroom. Happily, the practice has not become general, and most of us can still take our tub free from the possible intrusion of "central." But now comes the ubiquitous radio which bids fair to pursue us at every turn and to make desired isolation or retirement extremely difficult.

It will be recalled that a certain enterprising American railroad equipped a number of its special trains a few years ago with wireless telegraphing apparatus and then later added facilities so that passengers aboard those moving trains could be entertained with music picked up from the ambient air. German inventiveness, however, has gone somewhat further and has recently perfected a system of wireless telephony which makes it practicable to maintain vocal communication between moving trains and the centrals of certain cities lying within reach of the radio waves.

According to a dispatch to *The New York Times*, German trains running between Hamburg and Berlin are outfitted with the new apparatus; and some amusing aspects of the use of this telephone have been described. But there is a serious side to the matter. In this hurrying age of ours the need of periods of rest or relaxation are of vital importance, and a rail run often satisfies this need. How many of us often count upon a few hours of separation from business when boarding a train; and how shall we feel if this period of contemplation is to be broken in upon by a paging train guard or porter summoning us to the telephone? Such an ubiquitous convenience may prove a boon occasionally, but it might become a nuisance if generally installed on our railroads.

OUR MULTIPLYING MOTOR CARS

ACCORDING to authoritative figures, there were 20,200,000 motor vehicles registered and in service in the United States by the end of the year gone. This was a notable increase over the record of 1924, and plainly indicates that the point of absorption has not yet been reached. Of that stupendous total, no fewer than 17,659,491 vehicles were passenger cars. The automobile has ceased to be a luxury and has become a necessity in many parts of the country.

To a degree, the business of our motor-car builders is an indication of our general prosperity; and as long as the industry flourishes many contributive industries will have reason for rejoicing. This is especially true of the producers of essential metals, automatic machinery, machine tools, and a multiplicity of accessories.

In a recent editorial, *The Sun*, of New York, made an effective effort to bring home to its readers what an array of 20,200,000 motor cars would mean if all those cars were set in motion past a given point. The result is one that is well calculated to stagger the imagination. Let us quote: "If all those cars were marshaled in a procession, and if the parade began crossing 42nd Street, at Fifth Avenue, in the first minute of New Year's Day, and if the cars passed at the rate of forty a minute, without halt or delay, the last car would not cross the line until late on the 16th day of next December."

MERCHANT MARINE STATISTICS

SUCH is the title of a pamphlet issued by the Bureau of Navigation of the United States Department of Commerce; and this unpretentious brochure contains a fund of statistical data that should be carefully considered by the great bulk of our nation. Leaving aside the political aspects of the problem, the economic importance of a commensurate American merchant marine was clearly brought home to us at every stage of the World War and especially emphasized after we entered into that conflict.

A national merchant marine is to a maritime country what the delivery wagons or trucks are to any well-organized department store or industry; and the good will of the customer and the volume of the business done by the shop or the factory is in no small part contingent upon the control and the excellence of the delivery facilities employed. For years now, America has been producing vastly more raw materials and finished commodities than she could absorb, herself; and the welfare of our producers has hinged upon finding ready and profitable markets for the surplus in the marts of the world. In turn, access to those markets and the assurance of profitable returns have been to a measurable extent contingent upon the means of transport available for overseas carriage. Our people have profited most when their goods were shipped in American bottoms.

It is not necessary to go back more than 25 years to see how the situation has varied radically in the foreign water-borne commerce of the United States. In 1900, the total value of our imports and exports was $2,089,528,616; and of this commerce only 9.3 per cent. was moved to and from our ports in American bottoms. A year later, the participation of American ships in an increased business dropped to 8.2 per cent. Owing to the desperate situation in which we found ourselves after the outbreak of war, and thanks to the amazing enterprise of our people, we were able to call into being a sufficient fleet of merchant craft to handle 21.9 per cent. of our imports and exports in 1918—the total value of that trade that year amounting to $7,703,700,456. In 1920, when our foreign trade reached a climax of $11,874,997,809, our ships handled 42.7 per cent. of the incoming and the outgoing commodities. Since then, there has been a well-nigh steady decline in our participation, and out of the $7,610,871,728 worth of commodities involved in our foreign water-borne commerce of 1925, American ships carried but 34.1 per cent. of that business.

HOMER L. FERGUSON, President of the Newport Shipbuilding & Drydock Company, insists that "American shipping should carry at least 50 per cent. of American merchandise exported. The American public should demand that Congress take measures to place our merchant marine upon a firm basis. High-grade ships, with a minimum speed of 14 knots, suitable for line service, are the type that is most needed.

"The continuance of American prosperity demands an American merchant marine." Furthermore, Mr. FERGUSON says: "Ships are necessary for national defense because we have no assurance that the next war will be fought at home rather than abroad. National defense does not consist of waiting for the enemy to come over here. In time of war, when ships are needed, every vessel is a warship."

ROCK DRILLS BEGIN WORK ON MERSEY TUNNEL

A FEW weeks ago, to be exact, on December 16, PRINCESS MARY turned the golden key which served to open a valve in the air line leading to a group of pneumatic rock drills assembled at a point where a shaft will be sunk for the driving of the Mersey Tunnel at Liverpool. Immediately after turning that key, PRINCESS MARY said: "I declare the work started on this great scheme."

The tattoo of those fourteen drills was the prelude to a noisy orchestration that will grow in volume and probably continue for many months to come because of the magnitude of the task ahead. Much of the tunnel will, in all probability, have to be cut through sandstone, and this rock will be removed by drilling and blasting in order to insure rapid progress on the undertaking.

Our esteemed contemporary, *The Engineer*, of London, has said that the low cost fixed by the contractor for this work is due to the contractor's special experience and his use of special machinery for boring rock. The term boring in this case really meaning drilling, as

exemplified by the air drills which shared in the inaugural ceremonies. Compressed air will undoubtedly be used in numerous ways before the tunnel is completed; and one of these will be in grouting the space or spaces between the rock and the outer surface of the cast-iron lining of the tunnel.

The Mersey Tunnel is the biggest thing yet essayed in the way of a subaqueous vehicular tunnel. It will be large enough to accommodate four lines of traffic traveling on two levels, and will therefore have an internal diameter of 44 feet. The tunnel will have a total length of two miles, and it will underrun the Mersey at a point where that river is three-quarters of a mile wide. The estimated cost of the project is put at $24,250,000. This tunnel will be the means of providing improved transport facilities between Lancashire, Cheshire, North Wales, and the Midlands.

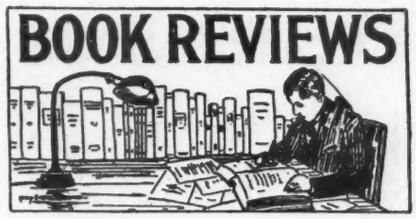
NEW SOURCE OF NEWSPRINT

AFTER experimenting on a satisfactory scale, the Forest Products Laboratory of the University of Wisconsin announces a new and plentiful source of raw material for the manufacture of newsprint paper at low cost. The eucalyptus tree is the one counted upon for this purpose. The wood used for the experiments was grown in the State of Sao Paulo, Brazil. The paper, so it seems, is of good quality and of ample strength for use in the high-speed presses which are commonly employed in newspaper plants.

According to an Associated Press dispatch: "The eucalyptus can be grown in California, New Mexico, Arizona, and Florida, where the climate is such that the tree would probably reach pulpwood size in less than ten years." This would insure us against any shortage of paper which might follow the depletion of existing stands of spruce. Paper made from eucalyptus can be produced, so it is believed, at about half the cost of the present newsprint paper coming to America from foreign sources.

Mr. Jesse Ditson, of Littleton, Colo., was made a fellow of the Royal Society of Arts of London two months ago. This honor was unexpected by the recipient, and was in recognition of the engineering work done by him in devising and developing an important group of air-operated equipment intended primarily to serve the mining industry. Mr. Ditson has been for years a member of the American Society of Mechanical Engineers and of the Colorado Society of Engineers, and has long been identified with the Littleton plant of the Ingersoll-Rand Company.

An important improvement in international railway service was made recently in Europe when an agreement was reached by the Swedish State Railways with German, Swiss, and Italian roads to ship directly from Varmland, Sweden, through Germany and Switzerland to various points in northern Italy. The first through shipment consisted of 18,000 tons of rayon cellulose. The total length of the new route is 1,243 miles, which can be covered in 10 days under normal conditions.



THE FIRST FORTY-NINER, by James A. B. Scherer, former President of the California Institute of Technology. An illustrated work of 127 pages, published by Minton, Balch & Company, New York City. Price, $1.50.

"GOLD! Gold! Gold from the American River!" In this manner Sam Brannan proclaimed a stupendous discovery and announced the era of the "forty-niners." Sam was the first of the forty-niners, and a flamboyant, colorful somebody whose story is entertainingly told by Mr. Scherer. Recalling how the discovery of gold on the Pacific slope brought about the transformation of that part of the continent, and added greatly to the wealth of the nation, it should be a matter of much interest to us at the present day to read the racy account of a man that played a not inconspicuous part in the pioneer days of that period. Sam Brannan was a character, but despite his bombast he was a natural leader of men—one that fitted well into the setting of the days of the forty-niners.

NIAGARA IN POLITICS, by James Mavor, Emeritus Professor of Political Economy in the University of Toronto. A book of 255 pages, published by E. T. Dutton & Company, New York City. Price, $2.00.

THIS book is really a critical account of the Ontario Hydro-Electric Commission, a Canadian quasi-governmental industrial enterprise which has been the target for much commendation as well as for condemnatory attack.

The general reader is aware that the Ontario Hydro-Electric Commission has been responsible for the development of hydro-electric plants utilizing the energy latent in the waters of the Niagara River, and has promoted the use of the current in communities in Canada and in the United States lying within the distributing range of the plants so controlled. As far as the consumer is concerned, it cannot be denied that he is getting cheaper electric current from the Commission than it would be possible for him to buy current from the average private-owned or public-service corporation. But, against this can be cited the hurtful consequences of political manipulation inseparably associated with government ventures in the field of industry.

Professor Mavor makes vividly manifest the shortcomings of the Ontario Hydro-Electric Commission while pointing out the theoretical benefits which were primarily responsible for the creation of the Commission. As he expresses it: "The Hydro is much larger than its promoters ever dreamed of; it is a great deal larger than they can manage. In point of fact, the Hydro cannot be controlled; it controls both its own officials and the Government." This book can be read to advantage by both the advocates and the opponents of government ownership in business.

THE TRAGEDY OF WASTE, by Stuart Chase. A volume of 296 pages, published by The Macmillan Company, New York City. Price, $2.50.

IN THE preparation of this book, Mr. Chase has had the coöperation of the entire staff of the Labor Bureau, Incorporated, and the facts and figures cited are, therefore, the joint product of many persons specializing in industrial problems covering substantially all phases of present-day departments of productive effort.

It is probably not an overstatement of the attitude of the popular mind to say that the public at large is convinced that our industrial habits are highly efficient; and it will, therefore, shock these people to learn that our practices are, on the contrary, woefully wasteful. Shocking as this awakening may be, still, if the awakening can be made a general one we, as a nation, will be the ultimate gainers by the shock—especially if we take the logical steps that will lead us into the path of better utilization of our forces, our facilities, and our abundant raw materials.

Ordinarily, books of this kind are more or less wearisome reading, but Mr. Chase has succeeded in making every page of his work interesting and, what is still more important, convincing.

BATS, MOSQUITOES, AND DOLLARS, by Dr. Charles A. R. Campbell. An illustrated volume of 262 pages, published by The Stratford Company, Boston, Mass. Price, $3.00.

ACCORDING to recognized authorities, mosquitoes are responsible for an annual sacrifice of 1,000,000 lives in India; in Greece, 36 per cent. of the population are afflicted with malarial disorders attributable to mosquitoes; and these insects entail a money loss yearly of $250,000,000 in the United States. On the face of it, the elimination of malaria is, therefore, one of the big problems confronting the sanitary engineer; and this can be accomplished by eradicating the mosquito which is the carrier of the disease germs.

Doctor Campbell has revealed how the propagation of bats and dragon flies, for instance, may be counted upon to aid effectually the sanitary engineer in getting rid of the malaria-spreading mosquito; and he has written a fascinating exposition of the life and the habits of the bat, especially, and has disclosed how the bat, besides preying upon the mosquito, is of notable economic value by reason of the guano which the bat produces. To most of us, the bat is an objectionable creature of the night, but the author makes plain that the bat is really a boon to mankind and susceptible of far greater usefulness than is commonly imagined.

Plans for the construction of a subway in Tokyo, Japan, have been completed, and it is estimated that the undertaking will cost in the neighborhood of $80,500,000. The expenditures are to be distributed over a period of 13 fiscal years, beginning with April 1, 1927.

The United States produced and consumed more goods in 1925, in proportion to its population, than ever before in the history of the country.

NIGERIA'S COMMERCIAL IMPORTANCE

NIGERIA, with a population estimated at 17,000,000 and covering an area of 336,000 square miles, is not only one of the richest tropical dependencies of the British Empire but the most advanced of all West African colonies. Its 1,126 miles of railway represent a capital investment of approximately $63,000,000.

An up-to-date through train, with dining and sleeping cars, is operated from Iddo, at tidewater, to Kano, 704 miles in the interior. Kano, itself, is becoming a modern city, maintaining contact with the outside world in ways little realized by foreigners. For example, prominent law firms and banks have permanent branch offices at Kano.

The commercial importance of Nigeria is indicated by its foreign trade, which was valued at approximately $135,800,000 for 1924—imports contributing $63,000,000 to this total and exports $72,800,000.

BUILDING A DAM ONLY TO WRECK IT

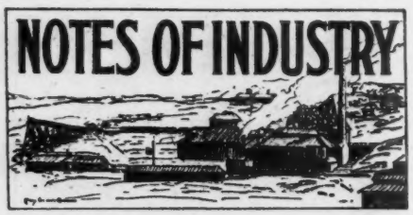
FOR a long while, the engineering fraternity has been puzzled at times by certain problems connected with the building and the powers of resistance to pressure of large dams. In the absence of positive data, the engineers have relied upon certain formulae of a more or less theoretical character to determine stresses and the best distribution of structural materials to meet them. This empirical method has left much to be desired; and the intention is to bring about the demolition of a dam of large size in such ways as will give engineering information of an essentially practical nature.

The dam in question is now building on Stevenson Creek, in California, and will cost, when complete, something like $100,000. The committee in charge of this great experiment is headed by Charles David Marx, professor emeritus of civil engineering at Leland Stanford Junior University. The tests will be conducted under the direction of W. A. Slater, an engineer-physicist of the United States Bureau of Standards.

The Southern California Edison Company, which is interested in the dam because of the dam's bearing on hydro-electric work, subscribed $25,000 towards the construction fund.

The cut of lumber this winter in the Province of Quebec will probably be one of the largest on record, according to information from official sources. Between 3,500 and 4,000 lumber camps are in operation, and something like 25,000 men are employed in the woods. The logging activity is confined largely to the cutting of pulpwood.

Plans for an air line connecting London, Paris, Marseille, Rome, Brindisi, and Athens are nearing completion. This new service will bring Greece in communication with London in 2½ days, with Paris in 2 days, and with Rome in 1 day. The London-Paris-Marseille section of the line is scheduled to begin operations on the 1st of May.



Back in 1880, when the steel industry of the United States was in its infancy, the yearly domestic consumption of steel amounted to 56 pounds per capita. Since then, the "age of steel" has brought about a steadily increasing demand for this commodity until, at the present time, the annual per capita steel requirement ranges anywhere from 800 to 900 pounds.

The British Columbia Chamber of Mines has recently made the announcement that asbestos, nearly equal in quality to that obtained from the world-famous Quebec deposits, has been found near Lytton, B. C.

Investigations looking to the use of gas instead of gasoline for the driving of motor cars have latterly been made under the direction of the ministries of War and Public Works of Rome, Italy. It was found that a run normally requiring approximately 1½ gallons of gasoline could be covered with 106 cubic feet of gas.

Figures compiled by the National Electric Light Association reveal that less than 5 per cent. of all the electricity sold in the United States is produced by municipal plants—the remaining 95 per cent. being supplied by privately operated power houses.

Some idea of the amount of artificial abrasives required for industrial purposes of one kind or another is brought out by the fact that the United States alone produces in an average year 30,000 tons of artificial grinding wheels.

The Roechling Steel Works at Wetzlar, Germany, have announced the discovery of a new alloy of wolfram and wolfram carbides to which the name of "Thoren" has been given. This alloy will melt at a temperature of 5,432°F—a higher temperature than that at which any of the tabulated metals can be fused. Thoren ranks in hardness next and very close to the diamond, which it is claimed to outlast in use.

More than a score of whole fossil fish and the parts of 50 others have been discovered on the Gaspé Peninsula, in eastern Quebec, by Prof. A. S. Romer of the department of paleontology of the University of Chicago. These specimens of prehistoric fish, so the *Canadian Fisherman* tells us, are estimated to be from 50,000,000 to 100,000,000 years old—in fact, many millions of years older than the dinosaur, and must have lived long before any land animals existed. A relative of these fossils, known as the French Fish, is found in African waters.

It is becoming increasingly difficult to find a spot in the habitable sections of this globe of ours that has not been invaded by American motor vehicles. Within the past six months 16 trucks have been exported to Greenland and 7 passenger cars to Iceland. And in the heart of Africa, in the Belgian Kongo, 87 American-made motor trucks and 29 passenger cars are now helping to bring widely separated areas closer together.

The introduction of coal-cutting and other machinery in Russian collieries has made it possible, so we are told by *The Engineer*, to increase production in those mines, to pay higher wages, and to reduce the cost of coal to the consumer. About 100 coal cutters are now in use in 32 collieries; and it is proposed to put in service in 40 other collieries a total of 235 such machines—150 large coal cutters and 85 of a smaller type.

In one of the largest chemical laboratories in the country an appreciable leak developed in the compressed-air line, and this leak could not be detected offhand because the line was embedded in a concrete floor. But by feeding a small quantity of amyl acetate into the compressor it was possible to locate the leak without much trouble, inasmuch as the odor of that colorless liquid soon made its presence known.

An interesting announcement has appeared in the press to the effect that four important powder-manufacturing companies have recently signed an agreement for the exchange of patents and inventions. The four companies in question are the Nobel Company of England, the Dynamite Company of Hamburg, the Koeln-Rottwell Company of Berlin, and the Du Pont Company of the United States.

To prolong the life of railroad ties after they have reached a stage when the spikes will no longer hold, the Western Australia Government Railways are using a special composition that is poured while hot into the spike holes. The spikes are then redriven; and after the fluid has cooled and set, in about a quarter of an hour, the spikes are so secure that a 2-ton pull is required to dislodge one of them. The composition, which should serve equally well in other directions, is a mixture of 1 quart tar, 4 ounces pitch, 1 pound bitumen, ½ pint kerosene, and 2 pounds hardwood sawdust sifted through a 100 mesh screen.

Through an advance statement, the United States Geological Survey reports that the mines of Alaska produced minerals to the value of $17,850,000 in 1925—an increase over the figures for the preceding year, which amounted to $17,457,333.

In the last quarter of a century, the traffic on our railroads has grown from 114,000,000,000 ton-miles yearly to 388,000,000,000 ton-miles.